Supporting Information

Transition Metal Arsenide Catalysts for the Hydrogen Evolution Reaction

Joseph A. Gauthier,†[1,2] Laurie A. King,†[1,2] Faith Tucker Stults,[1,2] Raul A. Flores,[1,2] Jakob Kibsgaard,[3] Yagya N. Regmi,[4] Karen Chan,[2] Thomas F. Jaramillo*†[1,2]

[1]SUNCAT Center for Interface Science and Catalysis, SLAC National Accelerator Laboratory, 2575 Sand Hill Road, Menlo Park, California 94025, United States

[2]SUNCAT Center for Interface Science and Catalysis, Department of Chemical Engineering, Stanford University, Stanford, California 94305, United States

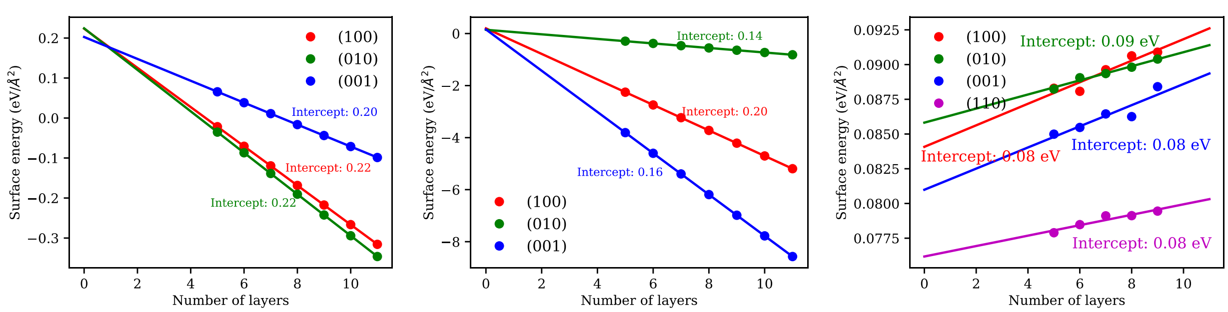
[3]Department of Physics, Technical University of Denmark, Fysikvej, Building 312, Dk-2800 Kongens Lyngby, Denmark

[4]Lawrence Berkeley National Laboratories, Energy Technologies Area, 1 Cyclotron Road, MS 0700108, Berkeley, California 94720, United States

† indicates these authors contributed equally to this work

* indicates corresponding author, jaramillo@stanford.edu

Surface energy calculations for the studied transition metal arsenides (TMAs) are shown in Figure S1.



(a) (b) (c)

Figure S1: Surface energies for low index facets on the three materials considered in this study.

DFT calculated formation energies

Figure S2 shows DFT calculated formation energies for various arsenide compounds, compared to a tabulated experimentalvalues.[1,2] For a compound M_xAs_y, the formation energy is given by the following expression:

$$E_{formation} = E_{compound} - E_{ref} \quad (3)$$

Where $E_{formation}$ refers to the formation energy of the compound, $E_{compound}$ refers to the calculated DFT energy of the compound, and E_{ref} refers to the energy of the atomic components of the compound, i.e.:

$$E_{ref} = x * E_M + y * (E_{AsH_3} - 1.5E_{H_2}) \quad (4)$$

Where E_M refers to the DFT calculated energy of the pure metal, E_{AsH_3} refers to the DFT calculated energy of the gas phase molecule AsH_3, and E_{H_2} refers to the DFT calculated energy of molecular hydrogen.

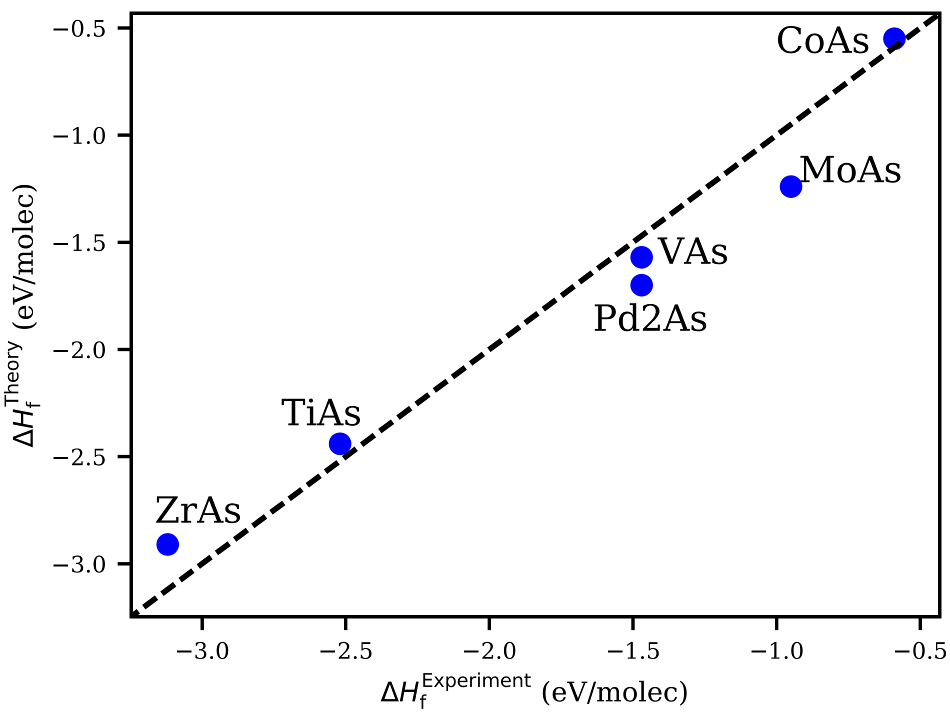


Figure S2: Comparison of theoretical and experimental formation energies for metal arsenide compounds

XRD Peak Indexing

The observed XRD peaks for each of the transition metal arsenide are tabulated in Table S1. Note, in addition to peaks for the predominant TMAs phase, Ti (substrate) and some TiO_2 peaks are observed, as well as a few unidentifiable peaks.

Table S1: Diffraction peaks observed by XRD (Figure 1).

MoAs 2θ	**Lattice Plane**	**Material**
33	111	MoAs
35	010	Ti
38	002	Ti
40	011	Ti
41	202, 112	MoAs
43	211	MoAs
44	103	MoAs
49	020	TiO_2(anatase)
54	012	Ti
60	104	MoAs
63	110	Ti
71	013	Ti
75	112	Ti
78	021	Ti

MoAs (00-018-0835) Ti (00-054-1294) TiO_2 - Anatase (00-021-1272)

CoAs 2θ	**Lattice Plane**	**Material**
34	111	CoAs
43	201, 121	CoAs
44	121	CoAs
46	211, 220	CoAs
54	031	CoAs
65	122	CoAs
72	222	CoAs

CoAs (00-052-0774)

Cu_3As 2θ	Lattice Plane	Material
35	112	Cu_3As
44	030	Cu_3As
45	113	Cu_3As
46	122	Cu_3As
48	020	TiO_2 (anatase)
51	032	Cu_3As
53	014	Cu_3As
65	223	Cu_3As

Cu_3As (04-004-5941)

Tafel Slope Analysis

Tafel slopes for each catalyst synthesized was calculated and are listed in Table S2.

Table S2: Tafel slopes for each of the synthesized transition metal arsenides

Material	Tafel Slope (mV dec^{-1})	Average Tafel Slope (mV dec^{-1})
CoAs	79, 79, 71	76
MoAs	73, 73, 76	74
Cu_3As	115, 125, 131	124

Electrochemical Active Surface Area Calculations

In order to directly compare electrocatalysts it is important to consider any differences in surface area. Thus, capacitance measurements were performed to compare the electrochemical active surface area of the prepared thin film catalysts.

The specific capacitance can be converted into an electrochemical active surface area (ECSA) using the specific capacitance for a flat standard with a 1 cm^2, shown in Equation 1.

$$A_{ECSA} = \frac{Measured\ specific\ capacitance\ \mu F\ cm^{-2}}{60\ \mu F cm^{-2} per\ cm^2_{ECSA}} \quad (1)$$

For ionic active hydrogen evolution catalysts, the specific capacitance is typically in the range of 20-60 uF cm^{-2}. Specifically, 60 uF cm^{-2} has been measured for CoP[3] and was therefore used to estimate the ECSA for each arsenide catalysts. To measure the electrochemical capacitance, the potential was swept in a region where no faradic processes are observed (0.1 and 0.3 V vs. RHE) three times at seven different scan rates (300, 250, 200, 150, 100, 50 and 20 mV s^{-1}). As a function of scan rate, a linear fit was used to determine the specific capacitance.

The electrochemically active area was determined for each catalyst synthesized. ECSA current densities were averaged for each transition metal arsenide (three electrodes per catalyst) and are shown in Figure S2.

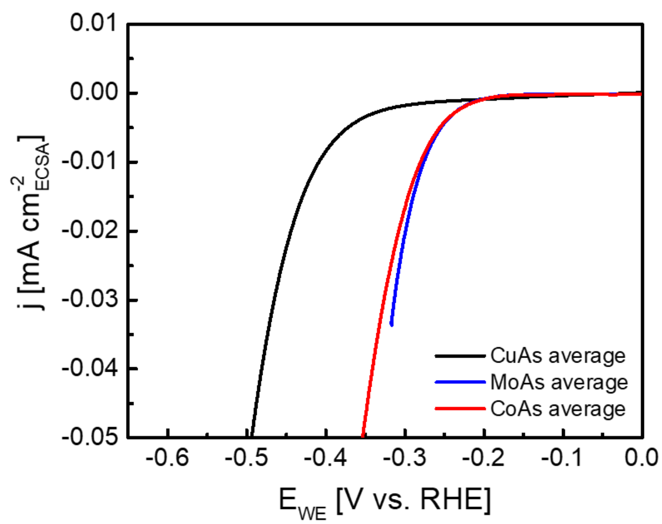


Figure S3: HER activity normalized for the electrochemical active surface area (ECSA).

Details of DFT Calculations:

Gibbs free energy of adsorption of hydrogen:

The Gibbs free energy of adsorption of hydrogen, ΔG_H was calculated using the following equation:

$$\Delta G_{\mathrm{H}} = E_{\mathrm{H}} - E_{*} - \frac{1}{2} G_{\mathrm{H}_2} + \Delta \mathrm{ZPE} - T\Delta S_0 \qquad (2)$$

In this expression, E_H refers to the DFT energy of the surface with hydrogen adsorbed, E_* refers to the energy of the surface without hydrogen adsorbed, G_{H2} refers to the calculated Gibbs free energy of a hydrogen molecule in the gas phase at 300 K and atmospheric pressure (where entropy is calculated using the harmonic approximation), ΔZPE is the change in zero point energy between the two states, T is the temperature (300 K) and ΔS_0 is the calculated entropic contributions, assuming the adsorbed hydrogen has only vibrational degrees of freedom.

Figure S4 illustrates the Pourbaix diagrams generated for each material and facet investigated, and Table S3 gives the corresponding predicted limiting potentials.

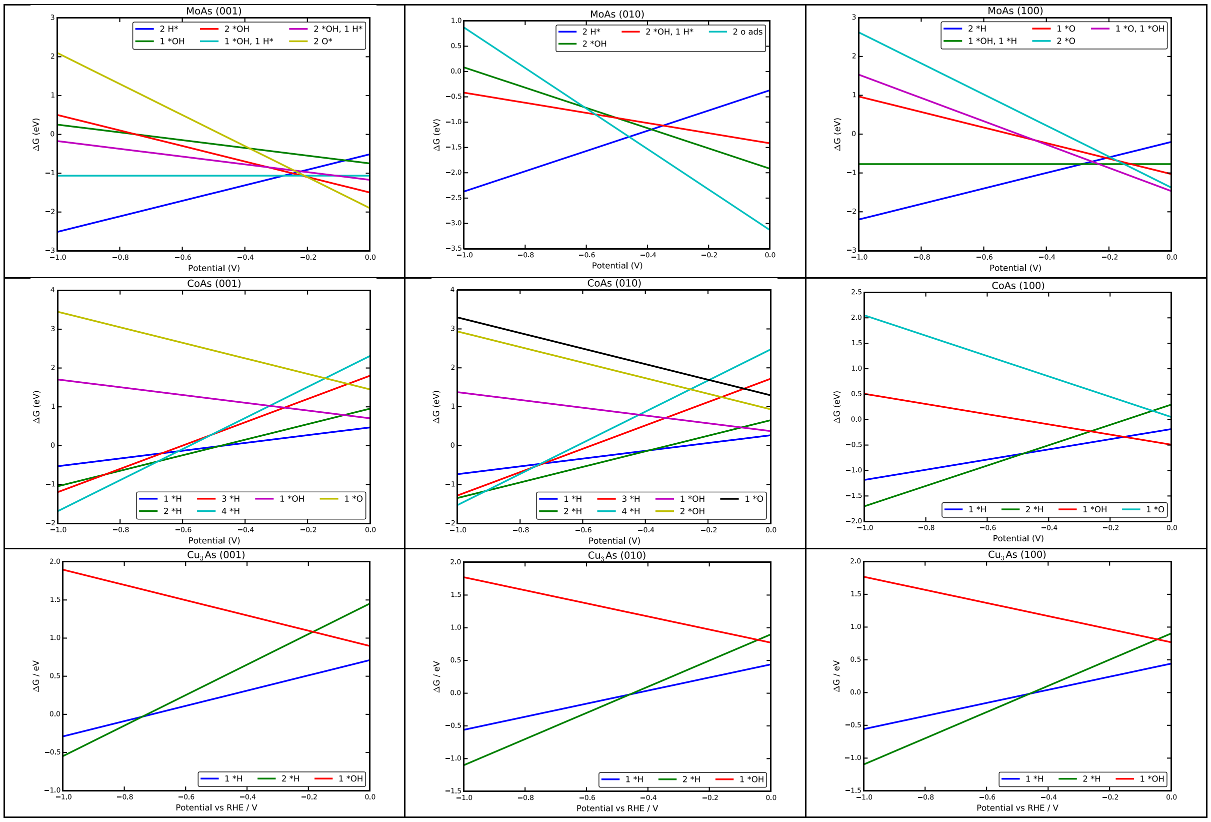


Figure S4: Pourbaix diagrams for each facet and material investigated theoretically.

Additional Volcano Plots

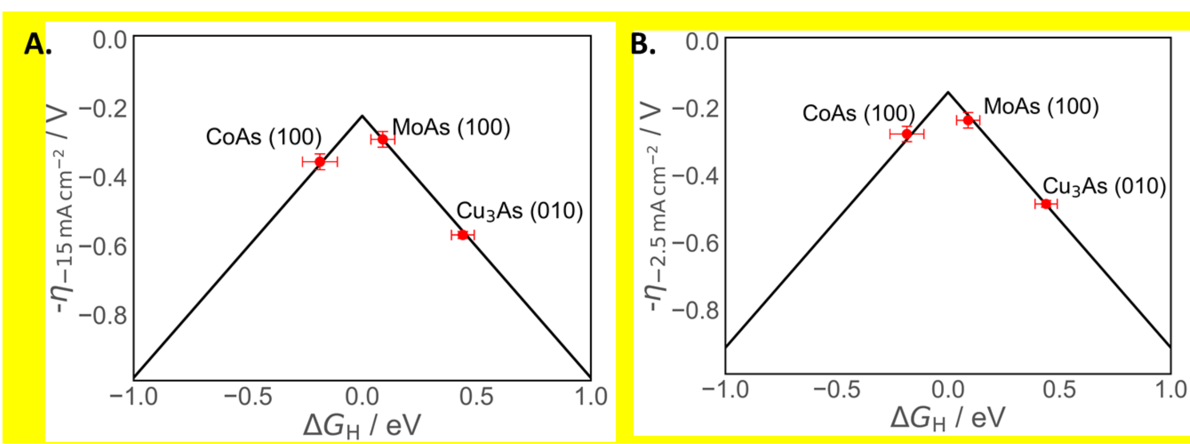


Figure S5. HER volcano plot for the transition metal arsenides plotting the experimentally measured overpotential required to reach (a) -2.5 mA cm-2 and (b) 15 mA cm-2 as a function of the calculated binding energy of hydrogen on the catalyst surface (ΔG_H).

SEM Post Electrochemistry

Post stability testing, the electrodes were examined by SEM, shown in Figure S7. In comparison with Figure 1(d – f), minimal changes in catalyst morphology were observed for the CoAs and MoAs. For Cu_3As, small features (50 – 100 nm) were observed on the surface post testing.

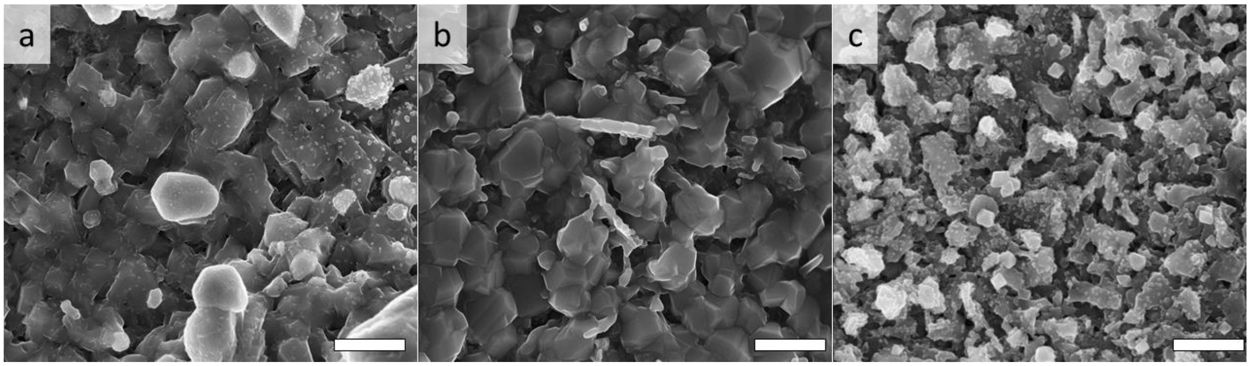


Figure S6. SEM micrographs of the transition metal arsenides electrodes post electrochemical stability measurements (Figure 2b). (a) CoAs, (b) MoAs and (c) Cu_3As. The scale bar is 1 µm.

Table S3 shows the unit cell parameters and a top-down image for each material and facet. Each structure used a 4x4x1 cell. Geometry optimizations were considered converged when the maximum force on any unconstrained atom was smaller than 0.03 eV/Å.

Table S3: Lattice parameters for each material and facet

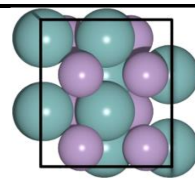
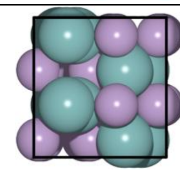
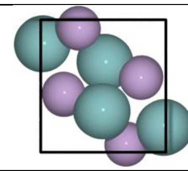
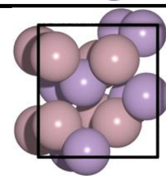
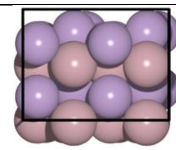
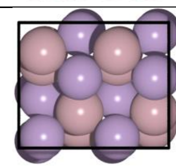
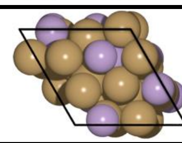
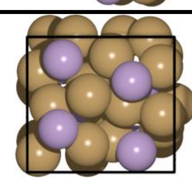
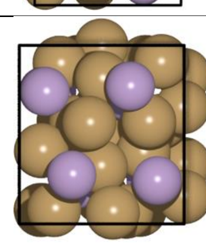
Material	a (Å)	b (Å)	c (Å)	Facet	Structure
MoAs	6.097	6.455	3.394	(001)	
				(010)	
				(100)	
CoAs	5.319	5.863	3.499	(001)	
				(010)	
				(100)	
Cu_3As	7.093	7.093	7.686	(001)	
				(010)	
				(100)	

Table S4: Limiting potentials for the materials and facets considered in this study.

Material	Facet	U_L (V vs RHE)
MoAs	(001)	-0.20
	(010)	-0.46
	(100)	-0.09
CoAs	(001)	-0.47
	(010)	-0.27
	(100)	-0.18
Cu_3As	(001)	-0.71
	(010)	-0.44
	(100)	-0.44

Calculation to compare charge passed during 2 h durability with that required to corrode the TMAs films via electrochemical reduction reactions

We have made a short calculation (shown below) that shows that the amount of current passed during the 2 h stability test is two orders of magnitude greater than if the entire TM-As film corroded during the 2 h durability measurements (operating at 20 mA/cm^2), and thus, it is not possible that the current passed is corrosion current:

How much charge was passed during the 2h durability experiment?

Current density = 20 mA/cm^2
= 0.02 A/cm^2
= 0.02 C/s/cm^2

Length of experiment = 120 mins
= 120 min x 60 s/min
= 7200 s

Charge passed during expt = 0.02 C/s/cm2 x 7200 s
= 144 C/cm^2

How much charge would pass if the entire CoAs film corroded via electrochemical a reduction reaction?

Catalyst loading on film = 0.25 mg/cm^2
= 0.00025 g/cm^2

CoAs M_w	= 133.85 g/mol
CoAs loading on film	= 1.86 x10^{-6} mol/cm^2
Number of Co atoms on film	= 1.12 x10^{18} atom/cm^2
Assume 1e^- corrosion reaction	= **0.18 C/cm^2**
Assume 3e^- corrosion reaction	= **0.54 C/cm^2**

References

(1) Gunn, B. Y. S. R. The Enthalpies of Formation of Arsine and Biarsinel. **1972**, *11*, 796–799.

(2) Miedema, A, R. On the Heat of Formation of Solid Alloys. *J. Less Common Met.* **1975**, *41*, 283–298.

(3) Hellstern, T. R.; Benck, J. D.; Kibsgaard, J.; Hahn, C.; Jaramillo, T. F. Engineering Cobalt Phosphide (CoP) Thin Film Catalysts for Enhanced Hydrogen Evolution Activity on Silicon Photocathodes. *Adv. Energy Mater.* **2016**, *6*, 1–8.

Tables corresponding to figures from the main text:

Figure 1:

1 (a)		1 (b)		1 (c)	
2Theta	Intensity	2Theta	Intensity	2Theta	Intensity
30.001	59.16104	30.051	24.46806	30	608.15
30.126	55.55963	30.176	19.1731	30.125	606.7
30.251	56.0327	30.301	15.55582	30.25	606.1
30.376	48.66022	30.426	10.86649	30.375	605.3
30.501	52.77809	30.551	8.57313	30.5	604.8
30.626	47.01111	30.676	8.1638	30.625	604.1
30.751	40.71857	30.801	7.65049	30.75	603.15
30.876	32.13458	30.926	6.54275	30.875	603.1
31.001	32.61096	31.051	5.53026	31	603
31.126	25.61885	31.176	4.03689	31.125	603.2
31.251	24.60259	31.301	4.41803	31.25	603
31.376	31.52229	31.426	3.53582	31.375	602.4
31.501	27.631	31.551	5.90655	31.5	601.85
31.626	23.60125	31.676	5.70601	31.625	602.8
31.751	23.32305	31.801	6.19742	31.75	603.1
31.876	17.02611	31.926	6.69203	31.875	603.2
32.001	17.13022	32.051	7.58982	32	604.8
32.126	15.55051	32.176	9.27571	32.125	605.4
32.251	35.5289	32.301	10.30542	32.25	606.6
32.376	37.41899	32.426	16.08645	32.375	607.8
32.501	47.87862	32.551	20.57871	32.5	610
32.626	63.31682	32.676	25.1964	32.625	613.35
32.751	78.26894	32.801	33.0543	32.75	616.85
32.876	95.62896	32.926	36.75921	32.875	620.25
33.001	86.93636	33.051	42.11064	33	622.95
33.126	93.89926	33.176	42.47654	33.125	622.6
33.251	73.29212	33.301	39.69026	33.25	619.55
33.376	47.92444	33.426	39.65775	33.375	617.65
33.501	39.63755	33.551	36.66914	33.5	613.4
33.626	23.69756	33.676	36.17174	33.625	611.65
33.751	32.75601	33.801	37.07037	33.75	609.95
33.876	42.06789	33.926	38.87936	33.875	609.5
34.001	72.70477	34.051	42.87957	34	608.05
34.126	150.7561	34.176	47.98143	34.125	608.15
34.251	222.9413	34.301	54.40862	34.25	607.05
34.376	290.1137	34.426	65.22495	34.375	606.6
34.501	332.4246	34.551	66.70675	34.5	607.15
34.626	360.2958	34.676	66.9821	34.625	608.1

34.751	420.0559	34.801	65.22871	34.75	610.25
34.876	507.1784	34.926	57.87544	34.875	614.8
35.001	594.2189	35.051	44.98601	35	617.05
35.126	659.6389	35.176	34.47587	35.125	619.15
35.251	577.4053	35.301	23.79609	35.25	619.6
35.376	438.4226	35.426	16.72262	35.375	618.15
35.501	299.8369	35.551	14.00765	35.5	617.5
35.626	189.7727	35.676	10.50471	35.625	615.3
35.751	98.15772	35.801	7.72805	35.75	614.05
35.876	53.55505	35.926	8.91867	35.875	613.4
36.001	26.76628	36.051	10.0141	36	613.25
36.126	20.4292	36.176	11.62232	36.125	615.25
36.251	26.41568	36.301	15.33682	36.25	619.05
36.376	31.56777	36.426	21.89553	36.375	622.9
36.501	23.15626	36.551	24.4053	36.5	626.4
36.626	33.18309	36.676	29.19429	36.625	630.5
36.751	36.16328	36.801	33.67538	36.75	633.05
36.876	34.54507	36.926	36.8979	36.875	634.55
37.001	38.80061	37.051	43.97731	37	633.55
37.126	59.18158	37.176	49.55995	37.125	631.75
37.251	47.6043	37.301	54.05847	37.25	629.75
37.376	63.01512	37.426	59.41156	37.375	628.6
37.501	63.45792	37.551	60.00861	37.5	630.6
37.626	72.0763	37.676	61.32486	37.625	637.55
37.751	110.1342	37.801	65.7635	37.75	648.3
37.876	133.3647	37.926	76.11728	37.875	663.15
38.001	140.0665	38.051	94.25862	38	683
38.126	149.4458	38.176	118.4605	38.125	700.35
38.251	113.7214	38.301	119.017	38.25	715.35
38.376	87.68816	38.426	102.798	38.375	723.2
38.501	69.59541	38.551	85.26803	38.5	713.85
38.626	51.80509	38.676	65.16741	38.625	699.2
38.751	40.21563	38.801	58.55079	38.75	677.75
38.876	43.73475	38.926	63.41895	38.875	657.25
39.001	67.66177	39.051	77.86321	39	645.45
39.126	93.20903	39.176	98.93604	39.125	641.5
39.251	152.3977	39.301	130.1164	39.25	642.9
39.376	236.6332	39.426	159.9782	39.375	650.2
39.501	369.5709	39.551	198.6192	39.5	661.95
39.626	583.8108	39.676	243.4635	39.625	675
39.751	868.9255	39.801	294.9703	39.75	688.45
39.876	1198.248	39.926	360.6466	39.875	706.9
40.001	1457.687	40.051	399.5068	40	728.7
40.126	1500.354	40.176	421.9199	40.125	759.65

40.251	1365.414	40.301	422.1136	40.25	784.6
40.376	1113.452	40.426	410.0509	40.375	797.9
40.501	791.3503	40.551	378.8445	40.5	794.5
40.626	506.4476	40.676	347.8336	40.625	768.3
40.751	332.0422	40.801	304.0453	40.75	735.5
40.876	214.9012	40.926	250.3847	40.875	703.4
41.001	140.9019	41.051	202.7217	41	679
41.126	107.4029	41.176	160.7954	41.125	665.15
41.251	80.01296	41.301	129.0902	41.25	656.3
41.376	66.62936	41.426	97.86873	41.375	650.7
41.501	41.1785	41.551	77.52886	41.5	646.25
41.626	17.02611	41.676	65.7483	41.625	644
41.751	22.60006	41.801	57.48447	41.75	641.9
41.876	16.55578	41.926	54.80393	41.875	642.35
42.001	25.39285	42.051	55.64647	42	640.5
42.126	15.57461	42.176	62.85946	42.125	640.55
42.251	27.89289	42.301	72.7604	42.25	641.35
42.376	51.97862	42.426	83.8262	42.375	641.8
42.501	69.11631	42.551	91.692	42.5	644.2
42.626	83.37673	42.676	96.35289	42.625	648.7
42.751	96.96187	42.801	97.15256	42.75	654.65
42.876	121.0908	42.926	86.5831	42.875	665.2
43.001	143.5394	43.051	80.88411	43	676.3
43.126	145.9715	43.176	76.38272	43.125	689.8
43.251	137.6942	43.301	72.78539	43.25	700.9
43.376	131.5279	43.426	70.62064	43.375	703.3
43.501	146.2026	43.551	73.87619	43.5	697.05
43.626	137.8147	43.676	72.69952	43.625	685.8
43.751	170.5805	43.801	75.48609	43.75	676.15
43.876	206.396	43.926	77.65366	43.875	668.35
44.001	211.7728	44.051	76.9025	44	666.4
44.126	202.0308	44.176	83.26664	44.125	669.7
44.251	181.3788	44.301	86.19661	44.25	673.8
44.376	137.9175	44.426	81.50786	44.375	675.15
44.501	125.0799	44.551	79.24343	44.5	674.35
44.626	118.6556	44.676	70.05717	44.625	668.85
44.751	90.78985	44.801	63.639	44.75	663.7
44.876	95.52417	44.926	56.02965	44.875	660.75
45.001	89.87918	45.051	48.34573	45	658.8
45.126	64.47924	45.176	43.69731	45.125	659.45
45.251	81.86161	45.301	34.13493	45.25	662.35
45.376	84.71254	45.426	30.27932	45.375	663
45.501	128.9618	45.551	20.61227	45.5	665.05
45.626	185.9572	45.676	16.11888	45.625	662.35

45.751	252.8995	45.801	13.52539	45.75	660.85
45.876	348.696	45.926	12.85881	45.875	654.4
46.001	377.8998	46.051	8.27349	46	650.85
46.126	400.9372	46.176	9.80605	46.125	647.05
46.251	339.8797	46.301	7.29364	46.25	646.35
46.376	312.42	46.426	7.55255	46.375	644.15
46.501	251.847	46.551	7.03854	46.5	642.8
46.626	211.0679	46.676	9.09423	46.625	642.25
46.751	143.0707	46.801	9.97223	46.75	642.45
46.876	124.5154	46.926	12.42712	46.875	641.8
47.001	100.3724	47.051	13.60356	47	642.75
47.126	106.0294	47.176	16.17443	47.125	646
47.251	110.417	47.301	19.45333	47.25	652.05
47.376	135.3109	47.426	24.45685	47.375	657.65
47.501	126.7233	47.551	34.19654	47.5	662.45
47.626	113.2279	47.676	40.75704	47.625	664.25
47.751	88.06098	47.801	46.74459	47.75	661.2
47.876	71.2318	47.926	55.48112	47.875	657.1
48.001	51.63733	48.051	60.65842	48	652.6
48.126	45.31801	48.176	67.36122	48.125	650.3
48.251	51.45702	48.301	78.73676	48.25	646.4
48.376	42.0458	48.426	91.35801	48.375	643.75
48.501	33.49112	48.551	98.47757	48.5	642.55
48.626	40.97719	48.676	99.85415	48.625	640.3
48.751	47.79223	48.801	90.19863	48.75	639.4
48.876	44.73363	48.926	77.95835	48.875	639.05
49.001	53.06353	49.051	65.05402	49	639.85
49.126	59.79406	49.176	55.96073	49.125	638.7
49.251	56.70477	49.301	51.99482	49.25	638.5
49.376	61.14968	49.426	44.14894	49.375	638.85
49.501	57.37329	49.551	34.93972	49.5	639.45
49.626	60.40293	49.676	28.89219	49.625	639.5
49.751	59.18276	49.801	21.25827	49.75	641.1
49.876	65.15505	49.926	13.73874	49.875	644.05
50.001	83.2285	50.051	8.13272	50	646.05
50.126	72.82044	50.176	6.08842	50.125	650.25
50.251	59.77294	50.301	2.86886	50.25	656.15
50.376	54.52328	50.426	1.54848	50.375	661.35
50.501	42.37741	50.551	2.01297	50.5	663.65
50.626	44.29093	50.676	2.39815	50.625	663.9
50.751	40.82487	50.801	5.24504	50.75	660.3
50.876	50.93878	50.926	5.81184	50.875	655.55
51.001	48.48462	51.051	6.55319	51	651.75
51.126	47.9832	51.176	4.78273	51.125	649.2

51.251	59.21882	51.301	6.67874	51.25	648.35
51.376	59.77403	51.426	8.08035	51.375	649.45
51.501	65.94155	51.551	9.69153	51.5	649.35
51.626	76.85758	51.676	12.69077	51.625	648.55
51.751	79.64424	51.801	15.60832	51.75	646.25
51.876	79.79205	51.926	20.70117	51.875	645.3
52.001	98.42099	52.051	24.9187	52	643.95
52.126	125.9863	52.176	31.29952	52.125	644.35
52.251	172.7325	52.301	35.29232	52.25	647.35
52.376	231.3067	52.426	38.38362	52.375	652.1
52.501	290.5158	52.551	40.43158	52.5	660.3
52.626	355.0725	52.676	48.45714	52.625	670.35
52.751	401.7638	52.801	59.66124	52.75	683.4
52.876	410.942	52.926	71.41708	52.875	695.35
53.001	386.3551	53.051	90.09067	53	706.05
53.126	342.5491	53.176	105.4547	53.125	711.5
53.251	282.2994	53.301	116.3128	53.25	713.5
53.376	246.2585	53.426	121.8539	53.375	708.25
53.501	238.2759	53.551	107.6505	53.5	695.5
53.626	243.6255	53.676	92.91003	53.625	680.75
53.751	289.5605	53.801	60.76131	53.75	667.5
53.876	320.3692	53.926	35.05801	53.875	658
54.001	318.3222	54.051	21.402	54	652.7
54.126	294.5632	54.176	13.23798	54.125	648.65
54.251	248.8114	54.301	9.56269	54.25	646.5
54.376	209.1621	54.426	8.93955	54.375	644.4
54.501	172.3572	54.551	5.44997	54.5	643.1
54.626	153.2736	54.676	3.26755	54.625	642.75
54.751	143.0208	54.801	3.27636	54.75	644
54.876	128.2579	54.926	4.38908	54.875	645.7
55.001	119.7638	55.051	7.05874	55	647.75
55.126	113.5601	55.176	5.96037	55.125	646.9
55.251	87.67585	55.301	5.07952	55.25	646.2
55.376	71.93624	55.426	6.57232	55.375	645.1
55.501	68.02191	55.551	7.16432	55.5	643.5
55.626	64.43393	55.676	6.75638	55.625	642.3
55.751	69.81479	55.801	5.38351	55.75	641.6
55.876	56.36087	55.926	7.3708	55.875	639.45
56.001	53.17443	56.051	7.84436	56	639.05
56.126	56.11247	56.176	12.93977	56.125	639.9
56.251	64.49558	56.301	12.99905	56.25	639.75
56.376	67.3231	56.426	15.94235	56.375	641
56.501	61.98469	56.551	19.78963	56.5	641.25
56.626	70.21206	56.676	25.02488	56.625	641.25

56.751	53.80281	56.801	30.12903	56.75	643.1
56.876	71.55713	56.926	31.26587	56.875	641.6
57.001	53.0014	57.051	32.46848	57	640.75
57.126	45.41422	57.176	29.52846	57.125	639.2
57.251	36.63842	57.301	29.52225	57.25	639.55
57.376	37.63116	57.426	24.26632	57.375	639.1
57.501	45.54896	57.551	19.99613	57.5	638.35
57.626	32.54622	57.676	14.98886	57.625	638.25
57.751	32.83997	57.801	16.98267	57.75	636.65
57.876	17.02611	57.926	13.73876	57.875	636.5
58.001	37.11399	58.051	12.98847	58	635.05
58.126	30.36698	58.176	13.94448	58.125	634.4
58.251	26.19384	58.301	17.35024	58.25	634.1
58.376	27.17252	58.426	16.99277	58.375	635.05
58.501	49.01963	58.551	17.44963	58.5	634.75
58.626	40.50542	58.676	20.48573	58.625	634.9
58.751	37.18334	58.801	23.52179	58.75	635.2
58.876	49.51855	58.926	26.53398	58.875	635.6
59.001	76.3985	59.051	26.59641	59	634.9
59.126	74.15731	59.176	29.91647	59.125	634.4
59.251	73.73656	59.301	31.21347	59.25	632.7
59.376	79.22683	59.426	27.66792	59.375	632.85
59.501	95.05577	59.551	26.39764	59.5	632.6
59.626	94.22388	59.676	24.33929	59.625	632.55
59.751	79.93502	59.801	22.94903	59.75	631.55
59.876	72.58076	59.926	18.28199	59.875	632.5
60.001	76.81509	60.051	13.25161	60	631.35
60.126	62.36559	60.176	12.37172	60.125	631.05
60.251	45.44653	60.301	9.49826	60.25	630.8
60.376	36.56343	60.426	5.4504	60.375	631.45
60.501	39.7598	60.551	3.42798	60.5	630.7
60.626	32.83729	60.676	7.10527	60.625	630.9
60.751	27.93275	60.801	6.8265	60.75	632.15
60.876	42.87093	60.926	8.06362	60.875	633.45
61.001	46.88384	61.051	12.73927	61	633.35
61.126	47.0571	61.176	13.24292	61.125	633.5
61.251	52.97753	61.301	13.06972	61.25	635.45
61.376	80.30553	61.426	15.08689	61.375	635.55
61.501	81.28379	61.551	18.08094	61.5	636.7
61.626	82.22257	61.676	19.19735	61.625	639.2
61.751	99.14886	61.801	21.2145	61.75	640.65
61.876	98.34203	61.926	24.18938	61.875	641.2
62.001	97.79316	62.051	22.90739	62	640.7
62.126	108.3819	62.176	22.72938	62.125	642.15

62.251	128.2368	62.301	24.1322	62.25	641.65
62.376	145.2869	62.426	24.74465	62.375	642.95
62.501	181.3368	62.551	25.77703	62.5	644
62.626	248.5768	62.676	29.68941	62.625	642.85
62.751	298.4122	62.801	33.98104	62.75	641.9
62.876	368.3269	62.926	36.08947	62.875	642.35
63.001	445.983	63.051	38.10991	63	642.25
63.126	477.8618	63.176	41.54637	63.125	642.6
63.251	467.0039	63.301	48.4139	63.25	644
63.376	444.5406	63.426	62.53171	63.375	644.5
63.501	344.1138	63.551	77.61217	63.5	643.45
63.626	242.0313	63.676	76.62219	63.625	643.25
63.751	185.9455	63.801	63.23967	63.75	640.6
63.876	105.5467	63.926	38.53695	63.875	638.4
64.001	68.44645	64.051	24.87947	64	636.75
64.126	59.74566	64.176	27.72956	64.125	635.8
64.251	44.84111	64.301	23.22999	64.25	633.65
64.376	36.49382	64.426	17.64399	64.375	633.5
64.501	45.34017	64.551	12.65167	64.5	632.65
64.626	39.48194	64.676	7.50241	64.625	631.2
64.751	42.999	64.801	7.50443	64.75	632.55
64.876	67.54195	64.926	6.38839	64.875	631.65
65.001	70.7532	65.051	4.9915	65	631.55
65.126	67.77062	65.176	5.67063	65.125	631.2
65.251	71.58538	65.301	5.45062	65.25	629.45
65.376	59.57577	65.426	4.46328	65.375	628.85
65.501	54.085	65.551	6.72407	65.5	629.1
65.626	50.52004	65.676	5.82319	65.625	627.75
65.751	34.50501	65.801	6.50951	65.75	627.05
65.876	35.0015	65.926	7.1815	65.875	626.85
66.001	31.24149	66.051	6.09575	66	626
66.126	25.7789	66.176	8.443	66.125	625.75
66.251	39.52187	66.301	5.97324	66.25	624.65
66.376	36.76719	66.426	8.92923	66.375	624.25
66.501	51.23444	66.551	8.12834	66.5	624.35
66.626	54.40347	66.676	8.90747	66.625	623.8
66.751	49.47599	66.801	8.78267	66.75	625.75
66.876	66.67753	66.926	7.30492	66.875	626.6
67.001	52.91024	67.051	10.26173	67	627.45
67.126	63.07557	67.176	9.56882	67.125	628.6
67.251	56.41805	67.301	11.44479	67.25	628.55
67.376	58.11417	67.426	12.03913	67.375	629.7
67.501	58.84374	67.551	13.64062	67.5	629.7
67.626	44.53439	67.676	17.10222	67.625	629.6

67.751	50.27022	67.801	17.51727	67.75	629.7
67.876	38.85357	67.926	21.45888	67.875	628.2
68.001	36.81431	68.051	19.85874	68	627.5
68.126	35.19932	68.176	19.89958	68.125	624.85
68.251	33.82134	68.301	14.31786	68.25	623.1
68.376	30.38142	68.426	12.69542	68.375	620.65
68.501	22.70407	68.551	9.99213	68.5	619.55
68.626	34.03478	68.676	8.56809	68.625	618.5
68.751	25.3161	68.801	5.86326	68.75	617.5
68.876	33.12462	68.926	4.27916	68.875	617.15
69.001	17.02611	69.051	6.37028	69	615.5
69.126	30.78732	69.176	9.04626	69.125	616.7
69.251	30.097	69.301	10.52756	69.25	615.3
69.376	38.51339	69.426	14.58171	69.375	617.25
69.501	34.78025	69.551	17.84147	69.5	617.15
69.626	42.94923	69.676	21.01561	69.625	619.2
69.751	50.48739	69.801	25.89056	69.75	620.95
69.876	63.55112	69.926	32.56864	69.875	624.55
70.001	70.68674	70.051	41.39807	70	628
70.126	86.2042	70.176	46.40086	70.125	633.3
70.251	93.86707	70.301	56.57909	70.25	637.3
70.376	101.4109	70.426	56.53798	70.375	644.2
70.501	104.6611	70.551	56.2442	70.5	648.15
70.626	109.5054	70.676	49.22065	70.625	655.5
70.751	102.5659	70.801	44.11891	70.75	658.1
70.876	100.52	70.926	31.32347	70.875	662.8
71.001	97.95617	71.051	24.04474	71	662.4
71.126	104.4586	71.176	24.30292	71.125	658.35
71.251	104.1962	71.301	24.30254	71.25	650.4
71.376	102.7652	71.426	29.09039	71.375	640.15
71.501	92.62749	71.551	24.8772	71.5	627.8
71.626	91.84906	71.676	23.84033	71.625	621.65
71.751	78.83121	71.801	10.78159	71.75	614.55
71.876	76.98823	71.926	7.75093	71.875	611.8
72.001	68.11456	72.051	5.81469	72	609.65
72.126	67.03094	72.176	4.29679	72.125	608.25
72.251	58.06069	72.301	5.43974	72.25	607.4
72.376	55.55278	72.426	4.3947	72.375	606.75
72.501	58.48394	72.551	2.67282	72.5	606.75
72.626	55.25877	72.676	3.12779	72.625	605.7
72.751	63.48924	72.801	2.91308	72.75	606.55
72.876	57.66171	72.926	5.74968	72.875	605.85
73.001	67.78815	73.051	5.63978	73	605.6
73.126	56.06038	73.176	9.18993	73.125	605.25

73.251	46.64738	73.301	11.45368	73.25	605.4
73.376	41.49459	73.426	14.12619	73.375	606.2
73.501	30.66351	73.551	18.27154	73.5	606.65
73.626	38.24756	73.676	20.51929	73.625	607.8
73.751	36.02166	73.801	21.17902	73.75	610.45
73.876	42.60773	73.926	21.73076	73.875	611.65
74.001	52.74298	74.051	21.18013	74	614.5
74.126	52.7386	74.176	19.26306	74.125	615
74.251	62.52082	74.301	20.12998	74.25	613.7
74.376	71.01278	74.426	21.77855	74.375	613.95
74.501	66.20353	74.551	21.95907	74.5	611.95
74.626	77.02309	74.676	24.61637	74.625	610.25
74.751	77.99079	74.801	26.82499	74.75	609.35
74.876	72.12737	74.926	22.62707	74.875	607.8
75.001	77.89761	75.051	23.56042	75	606.15
75.126	81.06649	75.176	21.10819	75.125	605.9
75.251	75.93648	75.301	17.08953	75.25	604.2
75.376	88.9	75.426	15.66526	75.375	603.4
75.501	94.00573	75.551	16.12979	75.5	604.15
75.626	98.76178	75.676	17.08155	75.625	603.95
75.751	123.0027	75.801	16.96206	75.75	604.3
75.876	144.3683	75.926	19.30345	75.875	606.2
76.001	165.2978	76.051	19.29998	76	608.55
76.126	194.8964	76.176	23.78858	76.125	611.35
76.251	210.2013	76.301	31.86015	76.25	615.6
76.376	201.7632	76.426	53.60227	76.375	620.35
76.501	181.354	76.551	60.50927	76.5	625.45
76.626	173.9584	76.676	48.29312	76.625	630.05
76.751	157.1296	76.801	26.64084	76.75	632.65
76.876	143.4929	76.926	15.84856	76.875	632.55
77.001	138.3629	77.051	10.92749	77	627.35
77.126	151.3632	77.176	8.29764	77.125	620.85
77.251	161.0828	77.301	6.87497	77.25	615.2
77.376	172.3955	77.426	7.53869	77.375	609.65
77.501	182.2914	77.551	8.58405	77.5	606.9
77.626	194.3832	77.676	7.74939	77.625	605.5
77.751	185.4185	77.801	7.52275	77.75	605.7
77.876	162.4119	77.926	9.47389	77.875	605.55
78.001	136.4715	78.051	15.88983	78	605.6
78.126	102.8827	78.176	22.37139	78.125	603.9
78.251	84.25676	78.301	24.64975	78.25	601.85
78.376	57.11484	78.426	22.32895	78.375	600.3
78.501	42.15281	78.551	15.5681	78.5	598.15
78.626	29.62269	78.676	11.79286	78.625	595.55

78.751	25.43481	78.801	9.21523	78.75	594.45
78.876	19.05313	78.926	7.55278	78.875	593.75
79.001	23.32993	79.051	8.67673	79	593
79.126	19.34565	79.176	10.8775	79.125	592.6
79.251	17.28522	79.301	11.28866	79.25	591.95
79.376	23.36812	79.426	11.20462	79.375	591.15
79.501	23.44622	79.551	11.20539	79.5	590.75
79.626	22.3918	79.676	9.43254	79.625	590.2
79.751	17.07327	79.801	9.13332	79.75	589.6
79.876	17.02611	79.926	7.07006	79.875	588.75
80.001	18.54755	80.051	7.67962	80	588.05

Figure 3:

3 (a)								
E_{WE} / V vs RHE	MoAs (t = 0) Current Density / mA cm^{-2}_{GEO}	MoAs (t = 2 hrs) Current Density / mA cm^{-2}_{GEO}	E_{WE} / V vs RHE	CoAs (t = 0) Current Density / mA cm^{-2}_{GEO}	CoAs (t = 2 hrs) Current Density / mA cm^{-2}_{GEO}	E_{WE} / V vs RHE	Cu3As (t = 0) Current Density / mA cm^{-2}_{GEO}	Cu3As (t = 2 hrs) Current Density / mA cm^{-2}_{GEO}
0.10306	-0.02029	0.07556	0.10284	0.02297	0.04917	0.00295	0.0103	0.13968
0.1021	-0.03648	0.06054	0.1019	0.01669	0.04249	0.00191	0.00711	0.12915
0.10098	-0.04299	0.05489	0.10081	0.01285	0.03891	9.34E-04	0.00517	0.12193
0.10004	-0.04706	0.05032	0.0998	0.01013	0.03588	-5.41E-05	0.00386	0.11595
0.099	-0.04038	0.05892	0.09879	0.00503	0.03392	-0.00107	0.00276	0.11033
0.09803	-0.04065	0.06227	0.09787	3.39E-04	0.03158	-0.00203	0.0018	0.10538
0.09705	-0.04252	0.06048	0.09677	-0.0013	0.02955	-0.00313	8.62E-04	0.1002
0.09602	-0.04345	0.05931	0.09575	-0.00266	0.02794	-0.00402	4.21E-04	0.09635
0.09496	-0.04489	0.05757	0.09478	-0.00411	0.02609	-0.00505	-3.26E-04	0.09192
0.09399	-0.04581	0.05594	0.09372	-0.00574	0.02563	-0.00603	-0.00117	0.08733
0.0931	-0.04633	0.05544	0.09268	-0.00704	0.02849	-0.00703	-0.00164	0.08382
0.09206	-0.047	0.05376	0.09161	-0.00854	0.02724	-0.00802	-0.00215	0.08045
0.09098	-0.04727	0.0534	0.09067	-0.00948	0.02612	-0.00904	-0.00281	0.07648
0.09001	-0.04713	0.052	0.08965	-0.01059	0.02502	-0.01003	-0.00315	0.07368
0.08906	-0.04734	0.05134	0.0887	-0.01185	0.02393	-0.01104	-0.00364	0.07023
0.08807	-0.04835	0.0499	0.08774	-0.0128	0.02312	-0.01205	-0.00418	0.06702
0.08707	-0.04763	0.04838	0.08672	-0.01369	0.02208	-0.01305	-0.00447	0.06474
0.08602	-0.04827	0.04724	0.08568	-0.01476	0.0211	-0.01401	-0.00485	0.06199
0.08502	-0.04852	0.04588	0.08464	-0.01536	0.02038	-0.01505	-0.00537	0.05915
0.08411	-0.04845	0.04429	0.08366	-0.01626	0.01949	-0.01603	-0.00555	0.0569
0.0831	-0.04796	0.04326	0.08267	-0.01703	0.01905	-0.01699	-0.00578	0.05504
0.08209	-0.04348	0.04357	0.08175	-0.01845	0.01842	-0.01798	-0.00619	0.05247
0.08116	-0.03733	0.03589	0.08086	-0.01848	0.01746	-0.019	-0.00671	0.04979

0.08012	-0.03684	0.03259	0.07984	-0.01959	0.01728	-0.02002	-0.00693	0.04798
0.07918	-0.03614	0.03088	0.07885	-0.01985	0.01658	-0.02105	-0.00724	0.04595
0.07819	-0.03797	0.02871	0.07789	-0.01988	0.01546	-0.02204	-0.0077	0.04342
0.07721	-0.03708	0.02754	0.0769	-0.02005	0.01527	-0.02298	-0.00799	0.04169
0.07608	-0.03708	0.02593	0.07598	-0.0199	0.01482	-0.02404	-0.00818	0.04
0.07509	-0.03819	0.02308	0.07496	-0.02003	0.01729	-0.025	-0.00866	0.03767
0.07412	-0.03783	0.02143	0.07394	-0.02027	0.01951	-0.02601	-0.0088	0.03649
0.07315	-0.03768	0.01981	0.07287	-0.02027	0.019	-0.02702	-0.0091	0.03473
0.07211	-0.03817	0.0184	0.07195	-0.02026	0.01854	-0.02803	-0.00954	0.03403
0.07108	-0.03896	0.01578	0.07089	-0.02048	0.01863	-0.029	-0.00971	0.02994
0.07005	-0.04014	0.01371	0.06994	-0.02033	0.01805	-0.03001	-0.00973	0.02795
0.06914	-0.04051	0.01185	0.06896	-0.02011	0.01779	-0.03101	-0.01038	0.02578
0.06805	-0.042	0.00866	0.06795	-0.02048	0.01714	-0.03198	-0.01049	0.02509
0.06702	-0.04361	0.00661	0.06695	-0.02047	0.01691	-0.03299	-0.01081	0.0236
0.06603	-0.04337	0.00494	0.06589	-0.02011	0.01697	-0.03401	-0.01104	0.02172
0.06496	-0.04443	0.00233	0.06483	-0.01995	0.01661	-0.03499	-0.01151	0.02109
0.06403	-0.0498	-0.00485	0.06385	-0.01707	0.01619	-0.036	-0.01194	0.01924
0.06307	-0.05182	-0.01494	0.06296	-0.01508	0.01616	-0.03702	-0.01203	0.01812
0.06209	-0.05403	-0.01798	0.06196	-0.01511	0.01571	-0.03804	-0.01254	0.01708
0.06114	-0.05478	-0.0203	0.06093	-0.01475	0.01574	-0.03906	-0.01264	0.01585
0.06021	-0.05592	-0.0219	0.05996	-0.01474	0.01545	-0.04004	-0.01286	0.01477
0.05914	-0.05799	-0.02431	0.05907	-0.01456	0.0152	-0.04106	-0.01338	0.01333
0.05823	-0.05942	-0.0261	0.05809	-0.01411	0.01505	-0.04203	-0.01349	0.01314
0.0571	-0.06028	-0.02752	0.0571	-0.01396	0.01635	-0.04303	-0.01351	0.01157
0.05613	-0.06177	-0.02994	0.05606	-0.01385	0.01911	-0.044	-0.01414	0.00992
0.05505	-0.06326	-0.03128	0.05514	-0.01358	0.0189	-0.04499	-0.01423	0.00959
0.05406	-0.06449	-0.03391	0.05403	-0.01375	0.01879	-0.04597	-0.01451	0.00855
0.05302	-0.06493	-0.0357	0.05301	-0.01322	0.01869	-0.04699	-0.01487	0.007
0.05206	-0.06711	-0.03856	0.05209	-0.01325	0.01816	-0.04798	-0.01502	0.00661
0.05102	-0.06786	-0.03931	0.05103	-0.01272	0.01823	-0.04904	-0.01541	0.0054
0.05005	-0.06884	-0.04156	0.05007	-0.01235	0.01836	-0.05	-0.01557	0.00409
0.04906	-0.0713	-0.04355	0.04907	-0.01243	0.01779	-0.05103	-0.01598	0.00399
0.04802	-0.07106	-0.04593	0.04801	-0.01223	0.0176	-0.05205	-0.0161	0.00302
0.04702	-0.07297	-0.0478	0.04706	-0.01207	0.01755	-0.05299	-0.01636	0.00188
0.04613	-0.08495	-0.06422	0.04606	-0.0078	0.0171	-0.05399	-0.01681	0.00118
0.04517	-0.0883	-0.06269	0.04509	-0.00774	0.01697	-0.05498	-0.01674	0.00105
0.04413	-0.08933	-0.06463	0.04401	-0.00753	0.01677	-0.05596	-0.01711	-1.56E-04
0.04315	-0.09098	-0.06588	0.043	-0.00756	0.01664	-0.05701	-0.01758	-0.00144
0.04219	-0.09203	-0.06736	0.04202	-0.00751	0.01635	-0.058	-0.01772	-0.00197
0.04117	-0.09407	-0.06792	0.04107	-0.00743	0.01616	-0.05896	-0.01798	-0.00243
0.04023	-0.09521	-0.06948	0.04015	-0.00725	0.01587	-0.05997	-0.0185	-0.00371
0.03914	-0.09676	-0.07052	0.03906	-0.00708	0.01606	-0.061	-0.01858	-0.00414
0.03818	-0.09788	-0.07089	0.03812	-0.00678	0.01599	-0.06201	-0.01909	-0.00466
0.03716	-0.09902	-0.07123	0.03719	-0.00657	0.01656	-0.06302	-0.01929	-0.00592

0.03613	-0.1012	-0.07204	0.03619	-0.00644	0.01606	-0.06404	-0.01949	-0.00612
0.0351	-0.10153	-0.07222	0.03519	-0.00606	0.01575	-0.06501	-0.01984	-0.0069
0.03408	-0.10305	-0.07222	0.03423	-0.00614	0.01555	-0.06598	-0.02018	-0.00823
0.03305	-0.10532	-0.07317	0.03324	-0.00645	0.01512	-0.06701	-0.02078	-0.00808
0.03211	-0.10661	-0.07307	0.03223	-0.00601	0.01507	-0.06799	-0.02066	-0.00811
0.03107	-0.10658	-0.07351	0.03124	-0.006	0.01486	-0.06899	-0.02121	-0.00956
0.03012	-0.1087	-0.07343	0.03025	-0.00629	0.01443	-0.06998	-0.02183	-0.01006
0.0292	-0.11353	-0.07068	0.02921	-0.00565	0.01442	-0.07099	-0.02197	-0.01063
0.02818	-0.12266	-0.0651	0.02813	-0.0056	0.01399	-0.07198	-0.02222	-0.0111
0.0272	-0.12359	-0.06466	0.0271	-0.00569	0.01358	-0.07297	-0.02282	-0.01211
0.02618	-0.12469	-0.06369	0.02611	-0.00581	0.01337	-0.07399	-0.0229	-0.01263
0.02513	-0.12528	-0.06395	0.0251	-0.00611	0.01321	-0.07497	-0.02337	-0.01275
0.02414	-0.12602	-0.06327	0.02407	-0.00634	0.01305	-0.07598	-0.02378	-0.01401
0.02305	-0.12779	-0.06292	0.02306	-0.00657	0.01265	-0.077	-0.02391	-0.01408
0.02203	-0.12844	-0.06251	0.02206	-0.00686	0.01245	-0.07802	-0.0242	-0.01442
0.02103	-0.12997	-0.06193	0.02106	-0.00713	0.01212	-0.07901	-0.02471	-0.01582
0.02011	-0.13175	-0.06248	0.0201	-0.00763	0.01204	-0.07999	-0.02479	-0.0155
0.01914	-0.13198	-0.06031	0.01906	-0.00801	0.00726	-0.081	-0.02491	-0.01561
0.0181	-0.1323	-0.05992	0.0181	-0.00809	0.00743	-0.08196	-0.02543	-0.01727
0.01709	-0.1344	-0.05979	0.01708	-0.00853	0.007	-0.083	-0.02611	-0.01711
0.01609	-0.13379	-0.05889	0.0161	-0.00877	0.00669	-0.08392	-0.02641	-0.01789
0.01509	-0.13629	-0.05812	0.0151	-0.00879	0.00621	-0.08495	-0.0267	-0.01853
0.01415	-0.13714	-0.05781	0.01411	-0.00929	0.00574	-0.08594	-0.02738	-0.01891
0.01308	-0.13747	-0.05648	0.0131	-0.00943	0.00547	-0.08701	-0.02773	-0.02003
0.01205	-0.13594	-0.0583	0.01211	-0.00985	0.00496	-0.088	-0.0279	-0.01977
0.01114	-0.14772	-0.04225	0.01094	-0.01384	0.00391	-0.08899	-0.0286	-0.02082
0.01006	-0.14796	-0.03804	0.01001	-0.01515	0.00373	-0.08998	-0.02866	-0.02075
0.00913	-0.14828	-0.03755	0.00901	-0.01542	0.00309	-0.09097	-0.02902	-0.02119
0.00817	-0.14924	-0.0364	0.00797	-0.01615	0.00304	-0.09196	-0.02962	-0.02216
0.0071	-0.14967	-0.03636	0.00705	-0.01651	0.00226	-0.09298	-0.02966	-0.02189
0.00614	-0.14961	-0.03554	0.00607	-0.01725	0.00184	-0.09393	-0.02963	-0.02226
0.00519	-0.14993	-0.03474	0.00509	-0.01772	0.00171	-0.09495	-0.03042	-0.02361
0.00415	-0.15092	-0.0349	0.00406	-0.01868	8.55E-04	-0.09601	-0.03062	-0.02341
0.00321	-0.15194	-0.03496	0.00302	-0.01896	6.64E-04	-0.09695	-0.03108	-0.02377
0.00225	-0.15169	-0.03302	0.00205	-0.01977	5.57E-05	-0.09794	-0.03139	-0.02501
0.0011	-0.15305	-0.03293	9.73E-04	-0.02035	-0.00356	-0.09897	-0.03217	-0.02464
2.03E-04	-0.15261	-0.03087	-1.09E-04	-0.02069	-0.00724	-0.09995	-0.03259	-0.02571
-7.86E-04	-0.15346	-0.03099	-0.00109	-0.02126	-0.00737	-0.10098	-0.03273	-0.02608
-0.00183	-0.15432	-0.03077	-0.00205	-0.02189	-0.00767	-0.102	-0.03356	-0.02647
-0.00283	-0.15432	-0.02925	-0.00304	-0.02255	-0.00805	-0.10297	-0.03366	-0.02692
-0.00382	-0.15491	-0.02904	-0.00401	-0.02313	-0.00896	-0.10398	-0.03407	-0.0276
-0.00478	-0.15611	-0.02955	-0.005	-0.02372	-0.00888	-0.10499	-0.03482	-0.02877
-0.00579	-0.15271	-0.02859	-0.00611	-0.02649	-0.00918	-0.10599	-0.03491	-0.02807
-0.00672	-0.14979	-0.01356	-0.00711	-0.03137	-0.00956	-0.10695	-0.03506	-0.02913

-0.00786	-0.15015	-0.01397	-0.00803	-0.03229	-0.01007	-0.10796	-0.03624	-0.03024
-0.0088	-0.15073	-0.01298	-0.00907	-0.03299	-0.0106	-0.10894	-0.03639	-0.02984
-0.00987	-0.15159	-0.01314	-0.01011	-0.03391	-0.01102	-0.10994	-0.03692	-0.03041
-0.01088	-0.15061	-0.01141	-0.01105	-0.03422	-0.01137	-0.111	-0.03758	-0.03143
-0.01181	-0.15165	-0.01184	-0.01207	-0.03524	-0.0119	-0.11196	-0.03787	-0.03102
-0.01292	-0.15072	-0.01093	-0.0131	-0.03561	-0.01216	-0.11296	-0.03882	-0.03236
-0.01378	-0.15075	-0.011	-0.01416	-0.03664	-0.01273	-0.11398	-0.03883	-0.03279
-0.01485	-0.15206	-0.01111	-0.01516	-0.03737	-0.01328	-0.11502	-0.03964	-0.03227
-0.01592	-0.15108	-0.0105	-0.01621	-0.03783	-0.01318	-0.116	-0.03961	-0.0331
-0.01678	-0.15043	-0.00923	-0.01712	-0.03832	-0.0155	-0.11697	-0.04001	-0.03366
-0.01799	-0.15209	-0.01003	-0.01808	-0.03879	-0.02094	-0.11802	-0.04084	-0.03392
-0.01885	-0.15157	-0.00964	-0.01903	-0.03938	-0.02094	-0.11899	-0.04061	-0.03355
-0.01986	-0.15197	-0.00878	-0.02004	-0.03999	-0.02112	-0.11992	-0.04097	-0.0348
-0.02084	-0.15177	-0.00908	-0.02101	-0.04047	-0.02178	-0.12098	-0.04187	-0.03605
-0.02187	-0.15122	-0.00999	-0.0221	-0.04091	-0.02178	-0.12194	-0.04196	-0.03618
-0.02285	-0.15134	-0.0104	-0.02311	-0.0413	-0.02249	-0.12294	-0.0425	-0.0365
-0.02382	-0.14304	-0.01137	-0.02416	-0.0444	-0.02263	-0.124	-0.04326	-0.03778
-0.02481	-0.1397	-0.01307	-0.02517	-0.04621	-0.02322	-0.12496	-0.04335	-0.03765
-0.02582	-0.13944	-0.01364	-0.02613	-0.04651	-0.02344	-0.12598	-0.0441	-0.03814
-0.02684	-0.13905	-0.01461	-0.02714	-0.04703	-0.02357	-0.12693	-0.04449	-0.03927
-0.02775	-0.14049	-0.01654	-0.02815	-0.04758	-0.02412	-0.12796	-0.04483	-0.03891
-0.02881	-0.13928	-0.01663	-0.02918	-0.04784	-0.02424	-0.12894	-0.04527	-0.03955
-0.02974	-0.13895	-0.01766	-0.03012	-0.04796	-0.02485	-0.12996	-0.04565	-0.04062
-0.03081	-0.13972	-0.01919	-0.03115	-0.04832	-0.02512	-0.13095	-0.04654	-0.04058
-0.03179	-0.13855	-0.0199	-0.03227	-0.04837	-0.02485	-0.13194	-0.04619	-0.04022
-0.03285	-0.13847	-0.02151	-0.0332	-0.04848	-0.02483	-0.13294	-0.04702	-0.04152
-0.0337	-0.13867	-0.02337	-0.03424	-0.04873	-0.02494	-0.1339	-0.04804	-0.04198
-0.03485	-0.13762	-0.02362	-0.03518	-0.0488	-0.02497	-0.13495	-0.0482	-0.04233
-0.03575	-0.13937	-0.02577	-0.03622	-0.04937	-0.0296	-0.1359	-0.04864	-0.04265
-0.03685	-0.13876	-0.02609	-0.03722	-0.04953	-0.03133	-0.1369	-0.04962	-0.04375
-0.03777	-0.13777	-0.02704	-0.0382	-0.04937	-0.03118	-0.13792	-0.04973	-0.04425
-0.03871	-0.13734	-0.02848	-0.03915	-0.04946	-0.0311	-0.13893	-0.05076	-0.0439
-0.03978	-0.13709	-0.03012	-0.04014	-0.04938	-0.03128	-0.13993	-0.0513	-0.04525
-0.04084	-0.13461	-0.033	-0.04118	-0.05075	-0.03122	-0.14098	-0.05137	-0.04475
-0.04187	-0.12021	-0.04818	-0.04191	-0.04736	-0.03117	-0.14195	-0.05195	-0.04525
-0.0429	-0.11943	-0.04961	-0.04295	-0.04707	-0.03117	-0.14295	-0.05267	-0.04647
-0.04381	-0.12111	-0.05253	-0.04406	-0.04725	-0.03152	-0.14395	-0.05297	-0.04573
-0.04491	-0.11934	-0.05364	-0.04491	-0.04696	-0.03135	-0.14496	-0.05294	-0.04568
-0.04579	-0.11948	-0.05651	-0.04596	-0.04687	-0.03145	-0.14591	-0.05379	-0.04705
-0.0469	-0.12088	-0.05994	-0.04697	-0.04671	-0.03189	-0.1469	-0.05498	-0.0469
-0.04779	-0.11967	-0.06175	-0.048	-0.0463	-0.03196	-0.1479	-0.05509	-0.04735
-0.04884	-0.12018	-0.06394	-0.04897	-0.04639	-0.03193	-0.1489	-0.05563	-0.04785
-0.04991	-0.1218	-0.06685	-0.05003	-0.04617	-0.03219	-0.14995	-0.05665	-0.04812
-0.05085	-0.12081	-0.06915	-0.05108	-0.0456	-0.032	-0.15091	-0.05698	-0.04919

-0.05189	-0.12031	-0.07145	-0.052	-0.04559	-0.03221	-0.15194	-0.05746	-0.04872
-0.05281	-0.12145	-0.07479	-0.05301	-0.04554	-0.03248	-0.15295	-0.05864	-0.04999
-0.05383	-0.12159	-0.07711	-0.05407	-0.045	-0.03277	-0.15393	-0.05874	-0.04968
-0.0549	-0.12088	-0.07986	-0.05497	-0.04446	-0.03687	-0.15494	-0.05929	-0.05012
-0.05583	-0.12138	-0.08284	-0.05601	-0.04432	-0.03725	-0.15593	-0.06032	-0.05134
-0.05689	-0.12117	-0.08578	-0.05697	-0.04411	-0.03729	-0.15692	-0.06042	-0.05078
-0.0579	-0.12049	-0.08782	-0.058	-0.04399	-0.03717	-0.15793	-0.06049	-0.05111
-0.05888	-0.11257	-0.10012	-0.05888	-0.03937	-0.03709	-0.1589	-0.06163	-0.05263
-0.05979	-0.10617	-0.11232	-0.05991	-0.03792	-0.03786	-0.15992	-0.06208	-0.052
-0.0609	-0.10578	-0.11393	-0.06091	-0.03758	-0.03743	-0.16092	-0.0627	-0.05279
-0.06178	-0.10587	-0.11588	-0.06188	-0.03693	-0.03756	-0.16188	-0.06306	-0.0538
-0.06291	-0.1063	-0.11983	-0.06294	-0.03656	-0.03775	-0.1629	-0.06424	-0.05351
-0.06382	-0.10508	-0.12196	-0.06397	-0.03573	-0.03779	-0.16387	-0.06478	-0.05478
-0.06482	-0.105	-0.1244	-0.06495	-0.03576	-0.03782	-0.1649	-0.06492	-0.05476
-0.06585	-0.10625	-0.12776	-0.06598	-0.03537	-0.03826	-0.16592	-0.06602	-0.05532
-0.06677	-0.10592	-0.12947	-0.06688	-0.03523	-0.03799	-0.16689	-0.06598	-0.05577
-0.06787	-0.10621	-0.13221	-0.06787	-0.03463	-0.03822	-0.1679	-0.06645	-0.05627
-0.06879	-0.10702	-0.13532	-0.06879	-0.03425	-0.03863	-0.16908	-0.0651	-0.05788
-0.06989	-0.10669	-0.13697	-0.06981	-0.03362	-0.03841	-0.17027	-0.06511	-0.05741
-0.07075	-0.10745	-0.13944	-0.07076	-0.03315	-0.03835	-0.17125	-0.06601	-0.05875
-0.07186	-0.10817	-0.14161	-0.0718	-0.033	-0.0383	-0.17224	-0.06702	-0.06045
-0.07286	-0.10809	-0.14432	-0.07286	-0.03255	-0.03995	-0.17324	-0.06713	-0.06034
-0.0738	-0.10919	-0.14679	-0.07389	-0.03252	-0.04215	-0.17424	-0.06768	-0.06096
-0.07484	-0.10814	-0.14744	-0.07482	-0.0319	-0.0421	-0.17525	-0.06864	-0.06247
-0.0758	-0.10798	-0.14956	-0.07579	-0.03086	-0.04263	-0.17625	-0.06882	-0.06202
-0.07674	-0.09246	-0.14809	-0.07674	-0.02808	-0.04234	-0.1773	-0.06952	-0.06325
-0.0778	-0.09249	-0.14819	-0.07771	-0.02814	-0.04262	-0.17824	-0.0703	-0.06399
-0.07869	-0.09343	-0.14853	-0.07859	-0.02832	-0.04271	-0.17925	-0.07045	-0.06357
-0.07973	-0.09288	-0.14647	-0.07963	-0.02791	-0.0423	-0.18025	-0.07082	-0.0644
-0.08076	-0.09321	-0.1454	-0.08073	-0.02811	-0.0424	-0.18125	-0.07157	-0.06483
-0.08172	-0.09496	-0.14493	-0.08165	-0.02828	-0.04241	-0.18227	-0.07198	-0.06558
-0.08279	-0.0945	-0.14412	-0.08253	-0.02802	-0.04251	-0.18321	-0.0718	-0.06487
-0.08375	-0.09428	-0.14276	-0.08358	-0.02795	-0.04267	-0.18423	-0.07252	-0.06601
-0.08473	-0.09571	-0.14213	-0.08469	-0.02813	-0.04276	-0.18525	-0.07352	-0.06428
-0.08574	-0.09597	-0.1415	-0.08566	-0.02779	-0.04252	-0.18624	-0.07373	-0.06561
-0.08675	-0.09788	-0.14129	-0.08662	-0.02841	-0.04309	-0.18725	-0.07415	-0.06663
-0.08778	-0.09769	-0.13947	-0.08779	-0.02855	-0.04265	-0.18821	-0.0752	-0.06687
-0.08871	-0.09843	-0.13826	-0.08872	-0.02849	-0.04294	-0.18922	-0.07549	-0.06805
-0.08979	-0.09826	-0.13659	-0.0896	-0.02885	-0.0425	-0.19023	-0.07581	-0.06811
-0.09071	-0.09807	-0.13491	-0.09081	-0.02887	-0.04278	-0.19122	-0.07664	-0.06922
-0.09176	-0.10024	-0.13382	-0.0918	-0.02971	-0.04561	-0.19225	-0.07666	-0.06944
-0.09278	-0.09969	-0.13126	-0.09271	-0.02966	-0.04568	-0.19323	-0.07709	-0.0698
-0.09373	-0.09467	-0.12318	-0.09382	-0.0307	-0.0458	-0.19422	-0.07799	-0.07121
-0.09478	-0.08824	-0.11468	-0.09496	-0.03521	-0.04598	-0.19526	-0.07803	-0.0703

-0.09581	-0.08849	-0.11173	-0.09596	-0.03596	-0.04582	-0.19623	-0.07785	-0.07128
-0.09672	-0.08869	-0.11061	-0.09683	-0.03659	-0.04584	-0.19724	-0.07916	-0.07266
-0.09775	-0.091	-0.11019	-0.09798	-0.03771	-0.04609	-0.19822	-0.07948	-0.07262
-0.09878	-0.09089	-0.10795	-0.09889	-0.03846	-0.04618	-0.1992	-0.07997	-0.07325
-0.09966	-0.0912	-0.10727	-0.09995	-0.03951	-0.04613	-0.20019	-0.08027	-0.07459
-0.10084	-0.09217	-0.10667	-0.10094	-0.04061	-0.04671	-0.20122	-0.08126	-0.07456
-0.10169	-0.09185	-0.10368	-0.10184	-0.04152	-0.04642	-0.2022	-0.08175	-0.07576
-0.10281	-0.09336	-0.10243	-0.10295	-0.04221	-0.04655	-0.20323	-0.08204	-0.0765
-0.10374	-0.09392	-0.10026	-0.10396	-0.04293	-0.04656	-0.20425	-0.08311	-0.07699
-0.10476	-0.09598	-0.09889	-0.10486	-0.04404	-0.04701	-0.20525	-0.08308	-0.07753
-0.10583	-0.09563	-0.09682	-0.10599	-0.04472	-0.0475	-0.20624	-0.08362	-0.07796
-0.10667	-0.09663	-0.09383	-0.10692	-0.04629	-0.04741	-0.20722	-0.08463	-0.07967
-0.10779	-0.0983	-0.09297	-0.10796	-0.04727	-0.04789	-0.20824	-0.08452	-0.07926
-0.10873	-0.09779	-0.0907	-0.10895	-0.04806	-0.04767	-0.20919	-0.08456	-0.08088
-0.10968	-0.09932	-0.08895	-0.10993	-0.04942	-0.04825	-0.21021	-0.08592	-0.08281
-0.11074	-0.10231	-0.08769	-0.11101	-0.05069	-0.04989	-0.21121	-0.0859	-0.08298
-0.11189	-0.09639	-0.08371	-0.11204	-0.05549	-0.05041	-0.21217	-0.08646	-0.08382
-0.11274	-0.09509	-0.0833	-0.11308	-0.05895	-0.05031	-0.21318	-0.08705	-0.08559
-0.11386	-0.0967	-0.08516	-0.11407	-0.06011	-0.05101	-0.21418	-0.08745	-0.08571
-0.11485	-0.09733	-0.08556	-0.11513	-0.06117	-0.05045	-0.21516	-0.08814	-0.08693
-0.11585	-0.09811	-0.08701	-0.11607	-0.06225	-0.05072	-0.2162	-0.08817	-0.08805
-0.11679	-0.09971	-0.0889	-0.11715	-0.06331	-0.05091	-0.21719	-0.08921	-0.08817
-0.11786	-0.10041	-0.09087	-0.11812	-0.06434	-0.05085	-0.21822	-0.0891	-0.08896
-0.11881	-0.10167	-0.09326	-0.11905	-0.06552	-0.05162	-0.21922	-0.08945	-0.09019
-0.1199	-0.10222	-0.09624	-0.12016	-0.0668	-0.05208	-0.22021	-0.09067	-0.09103
-0.12069	-0.10349	-0.09833	-0.1211	-0.06763	-0.05196	-0.22125	-0.09004	-0.09048
-0.12184	-0.10421	-0.10061	-0.12211	-0.0689	-0.05235	-0.2222	-0.09063	-0.09209
-0.12275	-0.10538	-0.10385	-0.12319	-0.07003	-0.05238	-0.22318	-0.09169	-0.0937
-0.12377	-0.10795	-0.10754	-0.12412	-0.0714	-0.05294	-0.2242	-0.09162	-0.09391
-0.12473	-0.10873	-0.10895	-0.12517	-0.07198	-0.05343	-0.2252	-0.0921	-0.09496
-0.12578	-0.10957	-0.11241	-0.12618	-0.07314	-0.05346	-0.22619	-0.09301	-0.0968
-0.12682	-0.112	-0.11674	-0.12718	-0.07451	-0.05387	-0.22719	-0.09325	-0.09721
-0.12781	-0.11254	-0.11925	-0.12824	-0.07482	-0.05474	-0.22819	-0.09441	-0.09817
-0.12881	-0.11552	-0.13003	-0.12933	-0.07648	-0.05631	-0.22918	-0.09472	-0.09979
-0.12988	-0.11527	-0.14642	-0.13028	-0.07828	-0.05739	-0.23018	-0.09504	-0.10003
-0.1308	-0.11565	-0.1491	-0.13122	-0.07871	-0.05797	-0.23117	-0.09536	-0.1013
-0.13183	-0.11698	-0.153	-0.13217	-0.0792	-0.05816	-0.23216	-0.09574	-0.10315
-0.13286	-0.11928	-0.15757	-0.13324	-0.07967	-0.05922	-0.23318	-0.09685	-0.10369
-0.13381	-0.12057	-0.16034	-0.13414	-0.0802	-0.05925	-0.23419	-0.09627	-0.10415
-0.13484	-0.12182	-0.16444	-0.13519	-0.08045	-0.05959	-0.23517	-0.09701	-0.10646
-0.13588	-0.12499	-0.16949	-0.13615	-0.08059	-0.06008	-0.23616	-0.09818	-0.10778
-0.13683	-0.12643	-0.1729	-0.13701	-0.0811	-0.0606	-0.23714	-0.0983	-0.10909
-0.13774	-0.13025	-0.17764	-0.13806	-0.08165	-0.06091	-0.23816	-0.09848	-0.11026
-0.1388	-0.13117	-0.17978	-0.13907	-0.08167	-0.06131	-0.23915	-0.09974	-0.11221

-0.13984	-0.13449	-0.18588	-0.14	-0.08215	-0.06226	-0.24011	-0.09957	-0.11371
-0.1408	-0.13639	-0.18875	-0.14105	-0.08193	-0.06258	-0.24119	-0.10073	-0.11449
-0.14184	-0.13836	-0.19288	-0.14204	-0.08228	-0.06312	-0.24216	-0.10116	-0.11667
-0.14277	-0.14226	-0.19817	-0.14298	-0.08229	-0.06442	-0.24319	-0.10158	-0.11755
-0.14374	-0.14397	-0.20202	-0.14393	-0.08253	-0.06462	-0.24418	-0.10204	-0.11874
-0.1448	-0.14587	-0.20657	-0.14499	-0.08239	-0.06571	-0.24513	-0.10313	-0.12106
-0.14574	-0.15026	-0.21153	-0.14602	-0.08328	-0.0665	-0.24618	-0.10343	-0.12201
-0.14678	-0.15807	-0.21962	-0.14705	-0.07822	-0.06741	-0.24717	-0.10308	-0.12268
-0.14772	-0.15989	-0.22311	-0.14794	-0.07675	-0.06932	-0.24817	-0.10402	-0.12581
-0.14875	-0.16426	-0.22549	-0.14892	-0.0773	-0.07016	-0.24912	-0.10527	-0.12682
-0.14969	-0.1664	-0.22611	-0.14986	-0.07725	-0.07064	-0.25012	-0.10533	-0.12831
-0.15076	-0.17132	-0.22779	-0.15094	-0.07757	-0.07199	-0.25111	-0.10595	-0.13055
-0.15166	-0.17476	-0.22835	-0.15186	-0.07769	-0.07268	-0.25215	-0.10731	-0.1319
-0.15277	-0.1778	-0.22897	-0.15277	-0.07798	-0.07374	-0.25314	-0.10759	-0.1344
-0.15361	-0.18167	-0.22921	-0.15382	-0.07784	-0.07433	-0.25419	-0.10793	-0.13563
-0.15468	-0.1859	-0.23018	-0.15482	-0.07808	-0.07567	-0.25514	-0.10931	-0.13829
-0.15565	-0.19153	-0.2321	-0.1558	-0.07885	-0.0769	-0.25616	-0.10933	-0.13992
-0.15674	-0.19501	-0.23248	-0.15676	-0.07936	-0.07786	-0.25711	-0.11017	-0.14166
-0.15762	-0.19974	-0.2329	-0.1578	-0.07963	-0.07869	-0.25814	-0.11134	-0.14455
-0.15865	-0.2061	-0.23464	-0.15871	-0.08057	-0.08041	-0.25916	-0.11156	-0.14555
-0.15967	-0.2099	-0.23462	-0.15978	-0.08085	-0.081	-0.26006	-0.11149	-0.14793
-0.16058	-0.21541	-0.2361	-0.1608	-0.08187	-0.0822	-0.26111	-0.11333	-0.15125
-0.16158	-0.22213	-0.23732	-0.16175	-0.08324	-0.08422	-0.26209	-0.11371	-0.1531
-0.16265	-0.22726	-0.2368	-0.16272	-0.08384	-0.08504	-0.26306	-0.11444	-0.15544
-0.16359	-0.23638	-0.23184	-0.16376	-0.08475	-0.08658	-0.26409	-0.11501	-0.15893
-0.16463	-0.249	-0.22523	-0.16469	-0.08078	-0.08817	-0.2651	-0.11634	-0.1609
-0.16564	-0.25511	-0.22497	-0.16569	-0.08256	-0.09005	-0.26612	-0.11715	-0.1643
-0.1668	-0.26117	-0.22654	-0.16666	-0.08383	-0.09172	-0.26711	-0.11751	-0.16682
-0.16765	-0.26867	-0.22757	-0.16767	-0.08542	-0.0933	-0.26812	-0.11878	-0.16938
-0.16857	-0.27627	-0.22987	-0.16862	-0.08731	-0.09484	-0.26911	-0.1192	-0.17195
-0.16969	-0.28448	-0.23173	-0.1696	-0.08924	-0.09623	-0.2701	-0.11977	-0.1745
-0.17059	-0.29204	-0.2329	-0.17058	-0.09094	-0.0978	-0.27112	-0.12147	-0.17837
-0.17155	-0.30097	-0.23606	-0.17157	-0.09353	-0.09996	-0.27214	-0.12165	-0.17974
-0.17265	-0.30855	-0.23709	-0.17257	-0.09566	-0.10147	-0.27307	-0.12183	-0.18325
-0.17359	-0.31669	-0.23914	-0.17359	-0.09785	-0.10337	-0.27408	-0.12379	-0.18753
-0.17452	-0.32708	-0.24191	-0.17457	-0.10082	-0.10586	-0.27506	-0.1242	-0.18997
-0.17557	-0.33624	-0.24431	-0.17555	-0.10362	-0.10739	-0.27605	-0.12512	-0.19321
-0.17654	-0.3473	-0.24702	-0.17655	-0.10627	-0.10927	-0.27707	-0.12646	-0.19755
-0.17752	-0.3579	-0.25011	-0.17756	-0.10963	-0.11176	-0.2781	-0.12737	-0.2003
-0.17857	-0.36773	-0.25311	-0.17855	-0.11293	-0.11333	-0.27908	-0.12858	-0.20434
-0.17945	-0.37876	-0.25693	-0.17962	-0.11629	-0.11561	-0.28006	-0.12936	-0.20815
-0.18046	-0.39096	-0.26222	-0.18064	-0.11976	-0.11876	-0.28106	-0.13109	-0.21121
-0.18145	-0.40834	-0.26461	-0.18166	-0.12485	-0.12094	-0.28213	-0.13172	-0.21497
-0.1825	-0.42613	-0.27551	-0.18274	-0.13094	-0.12317	-0.28309	-0.13281	-0.21919

-0.18338	-0.43923	-0.28214	-0.18382	-0.13551	-0.12594	-0.28407	-0.13464	-0.22326
-0.18436	-0.45377	-0.29119	-0.18475	-0.14028	-0.12868	-0.28502	-0.13472	-0.22613
-0.18545	-0.46653	-0.29998	-0.18576	-0.14521	-0.13115	-0.28602	-0.13606	-0.23085
-0.18628	-0.48013	-0.30851	-0.18684	-0.1505	-0.13423	-0.28704	-0.13811	-0.23606
-0.18733	-0.49704	-0.31872	-0.18777	-0.15606	-0.13758	-0.28803	-0.1388	-0.23983
-0.18828	-0.51182	-0.32886	-0.18875	-0.16123	-0.14093	-0.289	-0.14004	-0.24416
-0.18934	-0.52805	-0.33741	-0.1898	-0.16687	-0.14379	-0.28998	-0.14186	-0.24967
-0.19028	-0.54533	-0.34868	-0.19073	-0.17285	-0.14727	-0.29102	-0.1427	-0.25396
-0.19125	-0.56181	-0.35881	-0.19178	-0.17882	-0.15034	-0.29199	-0.14465	-0.25873
-0.19219	-0.57941	-0.37115	-0.19275	-0.18491	-0.15395	-0.29303	-0.14586	-0.26437
-0.19324	-0.59949	-0.38286	-0.19373	-0.19178	-0.15805	-0.29401	-0.14705	-0.2685
-0.19422	-0.61746	-0.39374	-0.19476	-0.19806	-0.16141	-0.295	-0.14835	-0.27354
-0.19512	-0.63773	-0.40799	-0.19572	-0.20486	-0.16551	-0.29603	-0.14977	-0.27978
-0.19601	-0.6591	-0.42176	-0.19674	-0.21204	-0.16986	-0.29702	-0.15186	-0.28463
-0.19708	-0.67963	-0.4349	-0.19773	-0.21909	-0.17392	-0.29799	-0.15215	-0.28901
-0.19808	-0.7028	-0.44887	-0.19888	-0.22734	-0.17846	-0.29897	-0.15399	-0.29597
-0.19901	-0.73359	-0.47878	-0.19987	-0.23981	-0.18282	-0.29995	-0.15658	-0.30189
-0.20007	-0.75763	-0.49376	-0.20083	-0.2479	-0.18702	-0.30098	-0.15757	-0.30798
-0.20101	-0.78303	-0.50902	-0.20177	-0.2561	-0.19193	-0.30194	-0.15925	-0.31392
-0.20191	-0.80761	-0.52427	-0.20278	-0.26453	-0.19479	-0.30295	-0.16178	-0.32149
-0.20289	-0.83508	-0.54086	-0.20376	-0.2735	-0.20054	-0.30393	-0.16285	-0.32762
-0.20394	-0.8606	-0.55562	-0.20481	-0.28224	-0.20566	-0.30499	-0.1649	-0.33393
-0.20492	-0.88927	-0.5728	-0.20576	-0.29158	-0.21092	-0.30596	-0.16708	-0.34196
-0.20578	-0.92001	-0.59089	-0.20669	-0.30108	-0.21662	-0.30697	-0.16842	-0.34803
-0.20675	-0.94838	-0.60715	-0.20774	-0.31034	-0.22219	-0.30794	-0.17015	-0.35516
-0.20777	-0.97939	-0.62466	-0.20867	-0.32057	-0.22801	-0.30891	-0.17262	-0.36346
-0.20876	-1.01227	-0.64419	-0.20968	-0.33118	-0.23401	-0.3099	-0.17437	-0.37031
-0.20971	-1.04507	-0.66401	-0.21064	-0.3416	-0.23973	-0.31093	-0.17524	-0.37686
-0.21062	-1.07939	-0.68325	-0.21165	-0.35237	-0.24608	-0.3119	-0.17796	-0.38655
-0.21158	-1.1159	-0.70551	-0.21268	-0.3633	-0.25303	-0.31289	-0.1808	-0.39413
-0.21263	-1.15194	-0.72554	-0.21365	-0.37479	-0.25984	-0.31392	-0.18256	-0.4026
-0.21351	-1.19061	-0.74804	-0.21465	-0.38674	-0.26666	-0.31487	-0.18471	-0.41141
-0.21443	-1.22948	-0.76967	-0.21563	-0.39882	-0.27386	-0.31586	-0.18809	-0.42013
-0.21536	-1.27339	-0.79338	-0.2167	-0.41196	-0.28083	-0.31684	-0.19014	-0.4301
-0.21622	-1.31898	-0.81744	-0.21755	-0.42507	-0.28822	-0.31784	-0.19239	-0.43833
-0.21725	-1.36061	-0.83856	-0.21863	-0.43793	-0.29607	-0.31881	-0.19558	-0.44862
-0.21822	-1.40591	-0.86156	-0.21958	-0.45218	-0.30456	-0.31986	-0.19748	-0.45758
-0.21906	-1.4507	-0.88318	-0.22055	-0.46585	-0.31164	-0.32084	-0.20009	-0.46724
-0.21998	-1.49694	-0.9066	-0.22155	-0.4804	-0.31867	-0.32184	-0.20347	-0.47812
-0.22104	-1.54625	-0.93074	-0.2224	-0.49597	-0.32787	-0.32283	-0.20569	-0.48712
-0.22185	-1.59411	-0.95527	-0.22354	-0.51082	-0.33703	-0.32378	-0.20758	-0.49728
-0.2228	-1.64522	-0.97991	-0.22432	-0.52652	-0.34602	-0.32474	-0.21179	-0.50929
-0.2238	-1.69809	-1.00711	-0.22536	-0.54274	-0.35606	-0.32573	-0.21477	-0.5194
-0.22475	-1.7519	-1.0344	-0.22626	-0.55851	-0.36543	-0.32676	-0.2178	-0.53073

-0.22557	-1.80826	-1.06322	-0.22732	-0.57606	-0.37625	-0.32773	-0.22071	-0.54295
-0.22653	-1.86497	-1.09172	-0.22822	-0.59315	-0.38668	-0.32869	-0.22481	-0.5541
-0.22752	-1.92423	-1.12152	-0.22918	-0.61084	-0.3972	-0.3297	-0.22805	-0.56678
-0.22839	-1.98444	-1.15177	-0.23016	-0.62883	-0.4079	-0.33072	-0.23079	-0.57906
-0.22921	-2.04662	-1.18269	-0.23109	-0.64797	-0.41953	-0.3317	-0.23485	-0.59162
-0.23026	-2.1114	-1.21541	-0.23208	-0.66748	-0.4316	-0.33272	-0.23765	-0.60437
-0.23122	-2.17726	-1.2491	-0.23292	-0.68773	-0.44357	-0.33366	-0.24084	-0.61723
-0.23212	-2.24001	-1.26766	-0.23401	-0.70313	-0.45577	-0.33468	-0.24546	-0.63205
-0.23305	-2.30704	-1.30262	-0.23498	-0.72298	-0.46882	-0.33567	-0.24839	-0.64403
-0.23393	-2.37815	-1.33733	-0.23593	-0.74441	-0.48153	-0.33661	-0.2512	-0.6582
-0.2347	-2.44963	-1.37501	-0.23698	-0.76704	-0.49494	-0.33762	-0.25633	-0.67294
-0.23566	-2.52627	-1.41358	-0.23774	-0.79058	-0.50876	-0.33861	-0.25979	-0.68912
-0.23664	-2.60438	-1.45392	-0.23877	-0.81453	-0.51919	-0.33958	-0.26371	-0.70466
-0.23745	-2.68437	-1.4963	-0.23972	-0.83978	-0.53407	-0.34054	-0.26839	-0.72175
-0.23829	-2.76736	-1.53956	-0.24074	-0.86491	-0.54867	-0.34156	-0.27226	-0.73727
-0.23928	-2.84966	-1.58306	-0.24156	-0.89048	-0.56358	-0.34255	-0.27757	-0.75331
-0.24021	-2.93572	-1.62855	-0.24253	-0.9166	-0.57927	-0.34354	-0.28125	-0.77091
-0.24095	-3.02483	-1.67524	-0.24356	-0.94441	-0.59506	-0.34455	-0.28635	-0.78696
-0.24185	-3.1159	-1.72323	-0.24449	-0.97294	-0.61168	-0.34549	-0.29058	-0.80381
-0.24275	-3.20809	-1.77322	-0.24553	-1.00124	-0.62847	-0.34648	-0.29503	-0.82222
-0.24367	-3.30342	-1.82376	-0.24632	-1.03057	-0.64569	-0.34746	-0.30105	-0.83924
-0.24448	-3.40175	-1.87624	-0.24739	-1.06136	-0.66387	-0.34847	-0.30474	-0.85612
-0.24541	-3.50056	-1.92991	-0.24829	-1.09232	-0.68129	-0.34946	-0.30973	-0.87587
-0.24637	-3.60123	-1.9853	-0.24926	-1.1241	-0.70017	-0.35046	-0.31598	-0.8949
-0.24719	-3.70726	-2.03774	-0.25034	-1.15661	-0.71981	-0.35141	-0.32083	-0.91436
-0.2481	-3.80344	-2.08234	-0.25121	-1.18667	-0.73928	-0.35234	-0.32629	-0.93438
-0.24881	-3.91406	-2.14255	-0.25199	-1.22177	-0.7592	-0.35333	-0.33277	-0.95506
-0.24975	-4.02881	-2.20552	-0.2531	-1.25852	-0.78016	-0.35438	-0.33805	-0.97594
-0.25058	-4.14453	-2.26826	-0.25398	-1.2955	-0.80128	-0.35532	-0.34439	-0.9967
-0.25143	-4.2627	-2.33444	-0.2549	-1.33312	-0.82219	-0.35626	-0.35032	-1.01926
-0.25227	-4.38414	-2.40319	-0.25596	-1.37279	-0.84315	-0.35728	-0.35657	-1.04053
-0.25313	-4.50825	-2.47298	-0.25676	-1.41244	-0.8623	-0.35828	-0.36253	-1.06297
-0.25394	-4.63589	-2.54367	-0.25775	-1.45334	-0.88539	-0.35924	-0.36895	-1.08707
-0.25478	-4.76652	-2.618	-0.25867	-1.49514	-0.90916	-0.36023	-0.37643	-1.10904
-0.25551	-4.89975	-2.69415	-0.25955	-1.53845	-0.93321	-0.3612	-0.38175	-1.13206
-0.2563	-5.03634	-2.77161	-0.26063	-1.58207	-0.95788	-0.36212	-0.38901	-1.15789
-0.25714	-5.17428	-2.85127	-0.26148	-1.62656	-0.98272	-0.36307	-0.39737	-1.18213
-0.25798	-5.31804	-2.93384	-0.26243	-1.67303	-1.00893	-0.36411	-0.40407	-1.20728
-0.25881	-5.46059	-3.01709	-0.26334	-1.72031	-1.03518	-0.36503	-0.4113	-1.23343
-0.25959	-5.60866	-3.10318	-0.26421	-1.76783	-1.06165	-0.36603	-0.42017	-1.25932
-0.26042	-5.76204	-3.19187	-0.26532	-1.81826	-1.09011	-0.36704	-0.42723	-1.28678
-0.26121	-5.91505	-3.28106	-0.26617	-1.86749	-1.11817	-0.368	-0.43612	-1.31374
-0.262	-6.06328	-3.37822	-0.26727	-1.9208	-1.14642	-0.36896	-0.44457	-1.34162
-0.26276	-6.22468	-3.47692	-0.26813	-1.97426	-1.17653	-0.36996	-0.45225	-1.36955

-0.26354	-6.38898	-3.57193	-0.26917	-2.02801	-1.20608	-0.3709	-0.4607	-1.39772
-0.26436	-6.55586	-3.67109	-0.26999	-2.08258	-1.23656	-0.37188	-0.46974	-1.42834
-0.26511	-6.72661	-3.7732	-0.271	-2.13957	-1.26834	-0.37287	-0.47853	-1.45643
-0.26589	-6.90081	-3.87717	-0.27197	-2.19646	-1.30023	-0.37381	-0.48645	-1.48647
-0.26668	-7.07887	-3.98253	-0.27273	-2.25495	-1.33294	-0.37475	-0.49611	-1.51865
-0.26754	-7.25919	-4.09091	-0.27383	-2.31523	-1.36226	-0.37571	-0.50673	-1.54966
-0.26824	-7.44581	-4.20185	-0.2746	-2.37607	-1.39573	-0.37668	-0.51585	-1.58122
-0.26898	-7.63473	-4.31555	-0.27555	-2.43887	-1.43087	-0.37762	-0.52556	-1.6145
-0.26976	-7.82559	-4.43092	-0.27649	-2.5019	-1.46642	-0.37867	-0.53674	-1.64691
-0.27056	-8.02134	-4.55058	-0.2773	-2.56721	-1.50273	-0.37959	-0.54681	-1.68136
-0.27126	-8.21876	-4.66928	-0.27839	-2.63251	-1.54	-0.38054	-0.55714	-1.71633
-0.27203	-8.41823	-4.79155	-0.27915	-2.69888	-1.5771	-0.38152	-0.56877	-1.75067
-0.27271	-8.62355	-4.91687	-0.28013	-2.76796	-1.61648	-0.38251	-0.57913	-1.78605
-0.2734	-8.83032	-5.0434	-0.28111	-2.83694	-1.6549	-0.38344	-0.59024	-1.82201
-0.27417	-9.03952	-5.17328	-0.28188	-2.90731	-1.69449	-0.38434	-0.60219	-1.85947
-0.27487	-9.2564	-5.3086	-0.28288	-2.98087	-1.73568	-0.38537	-0.61354	-1.89474
-0.27571	-9.48151	-5.45441	-0.28381	-3.05821	-1.77666	-0.38628	-0.62415	-1.93269
-0.27635	-9.70237	-5.59161	-0.28482	-3.13254	-1.81818	-0.38724	-0.63748	-1.97263
-0.27704	-9.92812	-5.7314	-0.28579	-3.20943	-1.86149	-0.38821	-0.65013	-2.01128
-0.27778	-10.15688	-5.87532	-0.28648	-3.2873	-1.90508	-0.38915	-0.66243	-2.05092
-0.27848	-10.39301	-6.02237	-0.28748	-3.36841	-1.95095	-0.39033	-0.67384	-2.09226
-0.27914	-10.63	-6.17113	-0.28841	-3.44811	-1.99597	-0.39145	-0.68938	-2.13361
-0.27977	-10.87253	-6.32129	-0.28916	-3.52977	-2.04228	-0.39243	-0.70388	-2.17591
-0.28052	-11.11306	-6.47446	-0.29011	-3.61192	-2.08826	-0.39334	-0.71748	-2.21939
-0.28118	-11.35887	-6.62849	-0.29103	-3.69556	-2.1332	-0.39434	-0.73153	-2.26184
-0.28196	-11.60516	-6.7879	-0.29177	-3.78186	-2.18247	-0.39526	-0.74557	-2.30579
-0.2826	-11.85597	-6.94866	-0.29266	-3.86745	-2.23137	-0.39622	-0.76012	-2.35064
-0.28328	-12.10871	-7.11167	-0.29369	-3.9546	-2.28208	-0.39715	-0.77636	-2.39566
-0.28394	-12.37199	-7.28011	-0.29453	-4.0443	-2.33397	-0.39809	-0.78986	-2.4398
-0.28457	-12.63269	-7.4486	-0.2953	-4.13425	-2.38581	-0.39901	-0.80551	-2.48651
-0.28527	-12.89763	-7.62113	-0.29624	-4.22472	-2.43861	-0.39995	-0.82259	-2.53397
-0.28593	-13.16769	-7.79849	-0.29715	-4.31865	-2.49359	-0.40093	-0.83795	-2.58101
-0.28653	-13.44516	-7.97747	-0.29791	-4.54805	-2.54797	-0.40184	-0.85408	-2.62938
-0.28722	-13.72495	-8.16371	-0.29903	-4.56999	-2.60485	-0.40277	-0.87204	-2.6794
-0.28778	-14.00941	-8.34844	-0.29985	-4.66974	-2.66135	-0.40372	-0.8883	-2.72913
-0.28841	-14.29086	-8.53355	-0.30077	-4.77011	-2.71905	-0.40466	-0.90607	-2.77976
-0.28907	-14.56495	-8.72038	-0.30167	-4.87031	-2.77715	-0.4056	-0.92453	-2.83149
-0.28968	-14.85177	-8.90919	-0.30252	-4.97434	-2.83717	-0.40653	-0.94211	-2.88308
-0.2903	-15.14156	-9.10301	-0.30335	-5.0785	-2.89691	-0.40746	-0.96017	-2.93526
-0.29088	-15.43446	-9.30054	-0.30423	-5.18405	-2.95828	-0.40844	-0.97896	-2.98977
-0.29151	-15.72817	-9.49726	-0.30508	-5.2921	-3.02014	-0.40936	-0.99799	-3.04299
-0.29209	-16.03016	-9.70484	-0.30591	-5.4011	-3.08236	-0.41022	-1.01604	-3.09561
-0.2927	-16.32989	-9.9114	-0.3068	-5.51155	-3.14768	-0.4112	-1.03555	-3.1525
-0.29329	-16.63425	-10.11801	-0.30762	-5.6225	-3.21227	-0.41212	-1.05671	-3.20805

-0.29391	-16.94253	-10.33118	-0.30845	-5.73495	-3.2796	-0.41303	-1.07648	-3.26472
-0.2945	-17.25968	-10.54285	-0.30931	-5.849	-3.3464	-0.41392	-1.09676	-3.32299
-0.29505	-17.58468	-10.7586	-0.31012	-5.97205	-3.41443	-0.4149	-1.11886	-3.38216
-0.29566	-17.92909	-10.98113	-0.31096	-6.08935	-3.48436	-0.41581	-1.13993	-3.44148
-0.29626	-18.25812	-11.19892	-0.31175	-6.2078	-3.55377	-0.41672	-1.16191	-3.50064
-0.29685	-18.58565	-11.42543	-0.31257	-6.32505	-3.6239	-0.41766	-1.18514	-3.56282
-0.29739	-18.90968	-11.65263	-0.3134	-6.45055	-3.69645	-0.41859	-1.20709	-3.6236
-0.29791	-19.2307	-11.87742	-0.31417	-6.5731	-3.76971	-0.4195	-1.23026	-3.68493
-0.29848	-19.56124	-12.11011	-0.31502	-6.6961	-3.84392	-0.42046	-1.25408	-3.74903
-0.29905	-19.8972	-12.34812	-0.31584	-6.82085	-3.91913	-0.42132	-1.27782	-3.8119
-0.29958	-20.24634	-12.58935	-0.31662	-6.94755	-3.99524	-0.42223	-1.30061	-3.87405
-0.30008	-20.60414	-12.83446	-0.31752	-7.07345	-4.07182	-0.42314	-1.32625	-3.93954
-0.30057	-20.95183	-13.08	-0.31835	-7.20275	-4.14961	-0.42403	-1.35163	-4.00563
-0.3012	-21.29403	-13.32946	-0.31914	-7.33225	-4.22952	-0.42499	-1.37689	-4.07148
-0.30178	-21.65054	-13.57919	-0.31998	-7.46565	-4.30997	-0.42582	-1.40262	-4.13831
-0.30231	-22.00726	-13.83253	-0.32079	-7.6012	-4.55846	-0.42676	-1.43017	-4.20619
-0.30291	-22.36167	-14.09527	-0.32161	-7.73735	-4.47912	-0.42769	-1.45666	-4.2757
-0.30338	-22.72866	-14.35672	-0.32242	-7.8696	-4.56065	-0.42857	-1.48353	-4.34557
-0.30394	-23.08435	-14.63124	-0.32319	-8.003	-4.64354	-0.42952	-1.5125	-4.41643
-0.30442	-23.45151	-14.90747	-0.32405	-8.1402	-4.72996	-0.43042	-1.54001	-4.48631
-0.30493	-23.82054	-15.17065	-0.32489	-8.27745	-4.81614	-0.43127	-1.56831	-4.55682
-0.30542	-24.21054	-15.44522	-0.3256	-8.4211	-4.90284	-0.4322	-1.59815	-4.63025
-0.30589	-24.64935	-15.72285	-0.32643	-8.56715	-4.99259	-0.43305	-1.62707	-4.70063
-0.30641	-25.03516	-16.0071	-0.32716	-8.7066	-5.08045	-0.43394	-1.65528	-4.7728
-0.30668	-25.40763	-16.28366	-0.32791	-8.8491	-5.16985	-0.43482	-1.68676	-4.84864
-0.30732	-25.79296	-16.5678	-0.32871	-8.9993	-5.2626	-0.43573	-1.71757	-4.92318
-0.30777	-26.21478	-16.8657	-0.32955	-9.15295	-5.35575	-0.43659	-1.7485	-4.99851
-0.30813	-26.6657	-17.15919	-0.33038	-9.3152	-5.45035	-0.43745	-1.78038	-5.07463
-0.3086	-27.07806	-17.45559	-0.33112	-9.4708	-5.5439	-0.4384	-1.81256	-5.15141
-0.30904	-27.50237	-17.75941	-0.3319	-9.62295	-5.6398	-0.43926	-1.8459	-5.23144
-0.30944	-27.89231	-18.07753	-0.33268	-9.77605	-5.73625	-0.44012	-1.87834	-5.31015
			-0.33345	-9.94345	-5.8329	-0.44101	-1.91316	-5.38905
			-0.33427	-10.11345	-5.9327	-0.44187	-1.94639	-5.46818
			-0.33495	-10.2695	-6.03295	-0.44278	-1.98074	-5.54877
			-0.33575	-10.42965	-6.13585	-0.44367	-2.01706	-5.6308
			-0.33657	-10.595	-6.239	-0.44452	-2.0512	-5.71074
			-0.33735	-10.75345	-6.34145	-0.44534	-2.08625	-5.79124
			-0.33806	-10.92085	-6.4452	-0.44626	-2.12353	-5.8762
			-0.33891	-11.0972	-6.5509	-0.4471	-2.15989	-5.95888
			-0.33969	-11.26655	-6.6566	-0.44796	-2.19724	-6.04428
			-0.34044	-11.429	-6.7627	-0.44885	-2.23544	-6.12984
			-0.34121	-11.5875	-6.8722	-0.44968	-2.27364	-6.2156
			-0.34188	-11.7608	-6.98055	-0.45059	-2.31348	-6.30257
			-0.34262	-11.9535	-7.08855	-0.45143	-2.35251	-6.38989

	-0.34334	-12.1281	-7.198	-0.45227	-2.39254	-6.47724
	-0.34408	-12.29025	-7.30915	-0.45317	-2.43204	-6.56478
	-0.34489	-12.453	-7.4208	-0.45396	-2.4728	-6.65401
	-0.3456	-12.62235	-7.53455	-0.45483	-2.51538	-6.74362
	-0.34639	-12.79575	-7.6509	-0.45568	-2.5551	-6.86039
	-0.34717	-12.97235	-7.7677	-0.45653	-2.59651	-6.95395
	-0.34782	-13.15405	-7.88315	-0.45738	-2.64051	-7.04447
	-0.34857	-13.34885	-8.0013	-0.45822	-2.68295	-7.13724
	-0.34935	-13.54135	-8.12145	-0.45906	-2.72643	-7.23224
	-0.35001	-13.7229	-8.24435	-0.4599	-2.77194	-7.32638
	-0.35076	-13.9048	-8.3677	-0.46073	-2.81603	-7.42539
	-0.35152	-14.0969	-8.49135	-0.46157	-2.86332	-7.51908
	-0.35227	-14.28875	-8.61465	-0.4624	-2.90907	-7.61493
	-0.353	-14.47425	-8.73625	-0.46322	-2.95545	-7.71171
	-0.35392	-14.6629	-8.85975	-0.46402	-3.00213	-7.80901
	-0.35461	-14.85195	-8.98535	-0.46487	-3.04956	-7.90704
	-0.35534	-15.0221	-9.11305	-0.46569	-3.09833	-8.00388
	-0.35605	-15.2204	-9.2405	-0.46655	-3.14482	-8.09961
	-0.35673	-15.4218	-9.37605	-0.46734	-3.19286	-8.20191
	-0.35751	-15.6184	-9.50975	-0.46813	-3.24438	-8.30118
	-0.35827	-15.81525	-9.63985	-0.46898	-3.29383	-8.39882
	-0.35893	-16.00885	-9.7696	-0.46976	-3.34397	-8.49914
	-0.35967	-16.19955	-9.9003	-0.47059	-3.39664	-8.59888
	-0.36033	-16.409	-10.03455	-0.47138	-3.44737	-8.70289
	-0.36103	-16.61825	-10.1661	-0.47223	-3.49947	-8.80664
	-0.36178	-16.8225	-10.30125	-0.47306	-3.55268	-8.91158
	-0.36253	-17.03575	-10.4427	-0.47387	-3.60518	-9.01717
	-0.36323	-17.2387	-10.58545	-0.47469	-3.65813	-9.12105
	-0.36395	-17.44195	-10.72805	-0.47544	-3.71222	-9.22605
	-0.36464	-17.6527	-10.8659	-0.4763	-3.76689	-9.32849
	-0.36535	-17.86785	-11.00475	-0.47702	-3.81931	-9.43026
	-0.36594	-18.09655	-11.1437	-0.47782	-3.87526	-9.53895
	-0.36678	-18.32245	-11.2821	-0.47862	-3.93164	-9.64592
	-0.36736	-18.5325	-11.42485	-0.47946	-3.98736	-9.75072
	-0.36811	-18.75075	-11.57605	-0.4802	-4.04344	-9.86145
	-0.36875	-18.9741	-11.72265	-0.48102	-4.10246	-9.97066
	-0.36929	-19.14305	-11.87135	-0.48185	-4.16045	-10.08257
				-0.48257	-4.21815	-10.19454
				-0.48341	-4.27853	-10.30316
				-0.48425	-4.33639	-10.4148
				-0.48497	-4.39611	-10.52678
				-0.48575	-4.4564	-10.63789
				-0.48656	-4.51646	-10.74691
				-0.48727	-4.57412	-10.86072

		-0.48808	-4.63574	-10.97454
		-0.48886	-4.69721	-11.08289
		-0.48962	-4.75853	-11.20046
		-0.49043	-4.82159	-11.31928
		-0.49118	-4.88533	-11.43362
		-0.49197	-4.94881	-11.54684
		-0.4927	-5.01264	-11.66572
		-0.49349	-5.07851	-11.78349
		-0.49424	-5.14222	-11.90026
		-0.495	-5.2071	-12.02329
		-0.4958	-5.27428	-12.14105
		-0.4965	-5.33915	-12.25388
		-0.49725	-5.40476	-12.37461
		-0.49807	-5.47276	-12.49447
		-0.49877	-5.54061	-12.61612
		-0.49952	-5.6087	-12.73822
		-0.50028	-5.67788	-12.86204
		-0.50104	-5.74707	-12.98362
		-0.50179	-5.81562	-13.10151
		-0.50253	-5.88581	-13.2298
		-0.50327	-5.95845	-13.34961
		-0.504	-6.02981	-13.47197
		-0.50471	-6.10155	-13.59263
		-0.50548	-6.17593	-13.71737
		-0.5062	-6.24546	-13.83638
		-0.50692	-6.31722	-13.96243
		-0.50767	-6.39269	-14.08651
		-0.5084	-6.46598	-14.20763
		-0.5091	-6.53948	-14.33145
		-0.50986	-6.615	-14.45855
		-0.51057	-6.68941	-14.58566
		-0.51149	-6.77809	-14.71033
		-0.51238	-6.86592	-14.84033
		-0.51307	-6.94211	-14.97132
		-0.5138	-7.02	-15.10039
		-0.51451	-7.09829	-15.23164
		-0.51522	-7.17855	-15.36743
		-0.51592	-7.25349	-15.49171
		-0.51657	-7.33546	-15.62855
		-0.51732	-7.41789	-15.75855
		-0.51802	-7.49737	-15.8877
		-0.51873	-7.57914	-16.02461
		-0.5194	-7.66243	-16.15349
		-0.52017	-7.745	-16.28757

		-0.52085	-7.82783	-16.41461
		-0.52158	-7.91368	-16.54237
		-0.52223	-7.99625	-16.67586
		-0.52291	-8.07987	-16.80836
		-0.52367	-8.1652	-16.94342
		-0.52433	-8.24783	-17.07395
		-0.52499	-8.33099	-17.20961
		-0.52569	-8.41704	-17.34513
		-0.52639	-8.50303	-17.49829
		-0.52702	-8.58789	-17.65204
		-0.52774	-8.67546	-17.79164
		-0.52844	-8.76224	-17.92
		-0.52912	-8.85145	-18.05546
		-0.5298	-8.93796	-18.19763
		-0.53049	-9.0273	-18.34342
		-0.53114	-9.11605	-18.48184
		-0.53179	-9.20533	-18.61888
		-0.5325	-9.29724	-18.76046
		-0.5332	-9.38434	-18.89158
		-0.53383	-9.47309	-19.02184
		-0.53447	-9.56618	-19.16586
		-0.53516	-9.65651	-19.30928
		-0.5358	-9.74816	-19.45355
		-0.53645	-9.84289	-19.60033
		-0.53717	-9.93625	-19.74362
		-0.53785	-10.03145	-19.87908
		-0.53852	-10.12612	-20.02651
		-0.53914	-10.22079	-20.16447
		-0.53975	-10.31507	-20.30145
		-0.54044	-10.41145	-20.44849
		-0.54105	-10.50934	-20.59605
		-0.54174	-10.60322	-20.72954
		-0.54239	-10.69855	-20.86816
		-0.54302	-10.79717	-21.01671
		-0.54367	-10.89447	-21.1552
		-0.54429	-10.99	-21.29289
		-0.54495	-11.09059	-21.43849
		-0.54558	-11.19066	-21.58559
		-0.54622	-11.28895	-21.73
		-0.54686	-11.39099	-21.88079
		-0.54751	-11.49039	-22.02822
		-0.54811	-11.59033	-22.1698
		-0.54876	-11.69217	-22.31428
		-0.54937	-11.79493	-22.46395

		-0.55002	-11.89408	-22.60309
		-0.55066	-11.99579	-22.75349
		-0.55123	-12.09934	-22.89763
		-0.55191	-12.20164	-23.04546
		-0.5525	-12.30428	-23.18974
		-0.55311	-12.41336	-23.33546
		-0.55377	-12.51395	-23.48697
		-0.55437	-12.62026	-23.62868
		-0.55499	-12.7252	-23.78474
		-0.55563	-12.82954	-23.93757
		-0.55624	-12.93572	-24.08934
		-0.55678	-13.04474	-24.23882
		-0.55746	-13.15007	-24.37743
		-0.55806	-13.25263	-24.52678
		-0.55865	-13.3602	-24.68342
		-0.55926	-13.4698	-24.82638
		-0.55988	-13.57717	-24.97132
		-0.5605	-13.68612	-25.11724
		-0.56107	-13.79914	-25.27572
		-0.56167	-13.9077	-25.42388
		-0.5623	-14.01928	-25.58849
		-0.56288	-14.12954	-25.74033
		-0.56348	-14.24171	-25.89447
		-0.56408	-14.35237	-26.05125
		-0.5647	-14.46796	-26.20079
		-0.56526	-14.57533	-26.34559
		-0.56588	-14.68434	-26.49263
		-0.56642	-14.79579	-26.65197
		-0.56702	-14.91046	-26.81632
		-0.5676	-15.02375	-26.97947
		-0.56823	-15.13678	-27.12105
		-0.56883	-15.25033	-27.27467
		-0.56937	-15.36921	-27.4252
		-0.56994	-15.4823	-27.58336
		-0.57051	-15.60388	-27.74434
		-0.57111	-15.71684	-27.89388
		-0.57165	-15.83763	-28.04013
		-0.57226	-15.95197	-28.2127
		-0.57281	-16.0698	-28.34829
		-0.57339	-16.18092	-28.49934
		-0.57397	-16.30066	-28.66882
		-0.57452	-16.42217	-28.83987
		-0.57511	-16.53737	-29.0023
		-0.57565	-16.65743	-29.16836

		-0.57618	-16.77941	-29.31816
		-0.57677	-16.90586	-29.48184
		-0.57733	-17.02375	-29.63145
		-0.5779	-17.14132	-29.77566
		-0.57844	-17.26158	-29.93651
		-0.57895	-17.39099	-30.10303
		-0.57955	-17.5102	-30.26007
		-0.58009	-17.63039	-30.38191
		-0.58064	-17.74664	-30.555
		-0.58121	-17.8777	-30.71862
		-0.58176	-17.9998	-30.87053
		-0.58232	-18.12303	-31.02395
		-0.58286	-18.25105	-31.19783
		-0.58338	-18.3752	-31.35414
		-0.58391	-18.50434	-31.51092
		-0.58449	-18.63112	-31.68171
		-0.58503	-18.76046	-31.84954
		-0.58521	-18.98572	-32.00625
		-0.58563	-19.13993	-32.15382
		-0.58616	-19.26645	-32.3225
		-0.58667	-19.39342	-32.48993
		-0.58723	-19.51612	-32.65368
		-0.58774	-19.64941	-32.82118
		-0.58828	-19.7798	-32.97941
		-0.58877	-19.91296	-33.14296
		-0.58931	-20.04803	-33.29855
		-0.58984	-20.18033	-33.44638
		-0.59034	-20.31822	-33.59599
		-0.59087	-20.44605	-33.78
		-0.5914	-20.57625	-33.93618
		-0.59191	-20.70224	-34.10039
		-0.59245	-20.83487	-34.25658
		-0.59298	-20.97105	-34.42
		-0.59342	-21.09691	-34.57809
		-0.59395	-21.23691	-34.74421
		-0.59443	-21.37638	-34.89184
		-0.59497	-21.51164	-35.06151
		-0.59549	-21.64711	-35.2248
		-0.59594	-21.78461	-35.40033
		-0.59645	-21.92072	-35.56526
		-0.59698	-22.05645	-35.74388
		-0.59747	-22.19046	-35.91066
		-0.59797	-22.32382	-36.0727
		-0.59845	-22.465	-36.2302

		-0.59896	-22.60691	-36.38961
		-0.59946	-22.74368	-36.54842
		-0.59995	-22.87908	-36.70072
		-0.60048	-23.01737	-36.8773
		-0.60091	-23.15414	-37.03829
		-0.60143	-23.30342	-37.21342
		-0.60187	-23.44447	-37.38197
		-0.60241	-23.58632	-37.53395
		-0.6029	-23.72211	-37.71132
		-0.60338	-23.86303	-37.86684
		-0.60387	-23.99961	-38.04803
		-0.60442	-24.1373	-38.2177
		-0.60482	-24.28625	-38.38151
		-0.60535	-24.42783	-38.55559
		-0.60584	-24.56868	-38.72474
		-0.6062	-24.67625	-38.81737

3 (b)	
Overpotential (t = 0) / V vs RHE	Overpotential (t = 2 hours) / V vs RHE

Figure 4:

4 (a)		
State	Intercept (x = 0)	Slope
1 H*	-0.185	1
2 H*	0.297	2
1 *OH	-0.493	-1
1 *O	0.05	-2

4 (b)		
State	Intercept (x = 0)	Slope
2 H*	-0.199	2
1 *O	-1.03	-2
1 *O, 1 *OH	-1.468	-3
1 *OH, 1 *H	-0.771	0
2 *O	-1.378	-4

4 (c)		
State	Intercept (x = 0)	Slope
1 H*	0.440	1
2 H*	0.898	2
1 *OH	0.773	-1

Figure 5

Material	ΔG_H / eV	U / V vs RHE at j = 10 mA cm^{-2}_{GEO}
CoAs (100)	-0.185	-0.33
MoAs (100)	0.09	-0.28
Cu_3As (010)	0.44	-0.54