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Hugoniot Models for Na and LiF from LEOS

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1 Contents of the data tables

In this document, we provide the Hugoniot for sodium from two models: LEOS table L110 and Lynx table 110. We also provide the Hugoniot for lithium fluoride from LEOS (L2240) and Lynx (2240). The Hugoniot pressures are supplied for temperatures between 338.0 and 1.16×10^9 Kelvin and densities between 0.968 and 11.5 *g/cc*. These LEOS models were developed by the quotidian EOS methodology, which is a widely used and robust method for producing tabular EOS data.[1, 2] Table 1 lists the model data for LEOS 110, Table 2 contains Lynx 110, Table 3 contains LEOS 2240, and Table 4 contains Lynx 2240. The Lynx models follow the same methodology as the LEOS models, however the Purgatorio[3] average-atom DFT code was used to compute the electron thermal part of the EOS. The models for Lynx are only listed at high compression due to known issues with the Lynx library at lower pressures.

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References

- [1] D. Young and E. Corey, J. Appl. Phys. **78**, 3748 (1995).
- [2] R. More, K. Warren, D. Young, and G. Zimmerman, Phys. Fluids **31**, 3059 (1988).
- [3] B. Wilson, V. Sonnad, P. Sterne, and W. Isaacs, JQSRT **99**, 658 (2006).

Table 1: Hugoniot model for Na based on LEOS L110

Density (g/cc)	Temperature (Kelvin)	Pressure (erg/cc)
1.080490e+00	3.382610e+02	1.065355e+10
1.170212e+00	3.944023e+02	2.129186e+10
1.243320e+00	4.598613e+02	3.146926e+10
1.304341e+00	5.361847e+02	4.126620e+10
1.360520e+00	6.251754e+02	5.149095e+10
1.409130e+00	7.289359e+02	6.114809e+10
1.456764e+00	8.499176e+02	7.133404e+10
1.503391e+00	9.909786e+02	8.184951e+10
1.550309e+00	1.155452e+03	9.308989e+10
1.598412e+00	1.347222e+03	1.053175e+11
1.647687e+00	1.570821e+03	1.185923e+11
1.698530e+00	1.831531e+03	1.330937e+11
1.751213e+00	2.135510e+03	1.490173e+11
1.805837e+00	2.489941e+03	1.666000e+11
1.862394e+00	2.903198e+03	1.861131e+11
1.920863e+00	3.385042e+03	2.078755e+11
1.981242e+00	3.946858e+03	2.322806e+11
2.043491e+00	4.601920e+03	2.598076e+11
2.107629e+00	5.365701e+03	2.910581e+11
2.173727e+00	6.256248e+03	3.267757e+11
2.241872e+00	7.294599e+03	3.678810e+11
2.312255e+00	8.505286e+03	4.155177e+11
2.384817e+00	9.916911e+03	4.711184e+11
2.458998e+00	1.156282e+04	5.364899e+11
2.534401e+00	1.348191e+04	6.139106e+11
2.610839e+00	1.571950e+04	7.062527e+11
2.688690e+00	1.832847e+04	8.170774e+11
2.768466e+00	2.137046e+04	9.508704e+11
2.850331e+00	2.491732e+04	1.113204e+12
2.934341e+00	2.905285e+04	1.310961e+12
3.020463e+00	3.387476e+04	1.552594e+12
3.108550e+00	3.949696e+04	1.848416e+12
3.198696e+00	4.605228e+04	2.211135e+12
3.291005e+00	5.369559e+04	2.656398e+12
3.385301e+00	6.260746e+04	3.203331e+12
3.481338e+00	7.299844e+04	3.875454e+12
3.578761e+00	8.511401e+04	4.701570e+12
3.677100e+00	9.924040e+04	5.717486e+12
3.775821e+00	1.157114e+05	6.967116e+12
3.874252e+00	1.349160e+05	8.504752e+12
3.971619e+00	1.573080e+05	1.039768e+13
4.067210e+00	1.834165e+05	1.272855e+13
4.160274e+00	2.138582e+05	1.559945e+13
4.250111e+00	2.493523e+05	1.913648e+13
4.335963e+00	2.907374e+05	2.349413e+13
4.417122e+00	3.389911e+05	2.886265e+13
4.492966e+00	3.952536e+05	3.547513e+13
4.562822e+00	4.608539e+05	4.361501e+13
4.626170e+00	5.373419e+05	5.362757e+13
4.682540e+00	6.265247e+05	6.592992e+13
4.731475e+00	7.305092e+05	8.102146e+13
4.772726e+00	8.517520e+05	9.949950e+13
4.806077e+00	9.931175e+05	1.220693e+14

Density (g/cc)	Temperature (Kelvin)	Pressure (erg/cc)
4.831362e+00	1.157945e+06	1.495528e+14
4.848497e+00	1.350130e+06	1.829012e+14
4.857433e+00	1.574211e+06	2.231956e+14
4.858167e+00	1.835484e+06	2.716409e+14
4.850801e+00	2.140119e+06	3.295720e+14
4.835481e+00	2.495316e+06	3.984285e+14
4.812479e+00	2.909464e+06	4.797409e+14
4.782224e+00	3.392348e+06	5.751536e+14
4.745276e+00	3.955377e+06	6.863954e+14
4.702483e+00	4.611852e+06	8.153629e+14
4.654814e+00	5.377283e+06	9.641971e+14
4.603449e+00	6.269752e+06	1.135346e+15
4.549721e+00	7.310344e+06	1.331804e+15
4.494863e+00	8.523644e+06	1.557145e+15
4.440168e+00	9.938315e+06	1.815741e+15
4.386689e+00	1.158778e+07	2.112896e+15
4.335296e+00	1.351101e+07	2.454916e+15
4.286704e+00	1.575343e+07	2.849362e+15
4.241314e+00	1.836803e+07	3.305075e+15
4.199416e+00	2.141658e+07	3.832477e+15
4.161141e+00	2.497110e+07	4.443776e+15
4.126446e+00	2.911556e+07	5.153155e+15
4.095242e+00	3.394787e+07	5.977213e+15
4.067348e+00	3.958221e+07	6.935261e+15
4.042535e+00	4.615168e+07	8.049769e+15
4.020571e+00	5.381149e+07	9.346965e+15
4.001200e+00	6.274259e+07	1.085737e+16
3.984169e+00	7.315600e+07	1.261653e+16
3.969244e+00	8.529772e+07	1.466593e+16
3.956194e+00	9.945460e+07	1.705386e+16
3.944809e+00	1.159611e+08	1.983662e+16
3.934895e+00	1.352072e+08	2.307986e+16
3.926277e+00	1.576476e+08	2.686008e+16
3.918796e+00	1.838124e+08	3.126648e+16
3.912312e+00	2.143198e+08	3.640304e+16
3.906698e+00	2.498905e+08	4.239098e+16
3.901842e+00	2.913649e+08	4.937164e+16
3.897647e+00	3.397228e+08	5.750981e+16
3.894024e+00	3.961067e+08	6.699759e+16
3.890900e+00	4.618486e+08	7.805898e+16
3.888207e+00	5.385017e+08	9.095514e+16
3.885887e+00	6.278770e+08	1.059905e+17
3.883890e+00	7.320859e+08	1.235202e+17
3.882173e+00	8.535904e+08	1.439581e+17
3.880696e+00	9.952610e+08	1.677867e+17
3.879427e+00	1.160445e+09	1.955689e+17

Table 2: Hugoniot model for Na based on Lynx 110

Density (g/cc)	Temperature (Kelvin)	Pressure (erg/cc)
2.592678e+00	3.994680e+04	1.396333e+12
2.753778e+00	4.656894e+04	1.691494e+12
2.941048e+00	5.428887e+04	2.074327e+12
3.151482e+00	6.328855e+04	2.579686e+12
3.376492e+00	7.378015e+04	3.238672e+12
3.606095e+00	8.601098e+04	4.085255e+12
3.833065e+00	1.002694e+05	5.159968e+12
4.052272e+00	1.168914e+05	6.511803e+12
4.260542e+00	1.362690e+05	8.202120e+12
4.455567e+00	1.588588e+05	1.030788e+13
4.634754e+00	1.851935e+05	1.292308e+13
4.795406e+00	2.158938e+05	1.616202e+13
4.934861e+00	2.516834e+05	2.016226e+13
5.050664e+00	2.934059e+05	2.508879e+13
5.140882e+00	3.420450e+05	3.113719e+13
5.204324e+00	3.987472e+05	3.853729e+13
5.240861e+00	4.648491e+05	4.755582e+13
5.251415e+00	5.419090e+05	5.849804e+13
5.237742e+00	6.317435e+05	7.170643e+13
5.202294e+00	7.364701e+05	8.755715e+13
5.148091e+00	8.585578e+05	1.064563e+14
5.078607e+00	1.000884e+06	1.288367e+14
4.998066e+00	1.166805e+06	1.551687e+14
4.912134e+00	1.360231e+06	1.860127e+14
4.829704e+00	1.585722e+06	2.222012e+14
4.766042e+00	1.848593e+06	2.653392e+14
4.738175e+00	2.155042e+06	3.182436e+14
4.757533e+00	2.512292e+06	3.853448e+14
4.812863e+00	2.928765e+06	4.711477e+14
4.879666e+00	3.414278e+06	5.791149e+14
4.928288e+00	3.980277e+06	7.104234e+14
4.937795e+00	4.640103e+06	8.633500e+14
4.904268e+00	5.409312e+06	1.035391e+15
4.834392e+00	6.306035e+06	1.224300e+15
4.743158e+00	7.351412e+06	1.430837e+15
4.644482e+00	8.570085e+06	1.659536e+15
4.547867e+00	9.990783e+06	1.916753e+15
4.459071e+00	1.164700e+07	2.210393e+15
4.380046e+00	1.357776e+07	2.548563e+15
4.311066e+00	1.582861e+07	2.940072e+15
4.251574e+00	1.845258e+07	3.394832e+15
4.200680e+00	2.151153e+07	3.923981e+15
4.157631e+00	2.507759e+07	4.539950e+15
4.121556e+00	2.923480e+07	5.259755e+15
4.091223e+00	3.408117e+07	6.102801e+15
4.065498e+00	3.973094e+07	7.089642e+15
4.044313e+00	4.631730e+07	8.239797e+15
4.027700e+00	5.399551e+07	9.578330e+15
4.015187e+00	6.294656e+07	1.113713e+16
4.005737e+00	7.338147e+07	1.295714e+16

Density (g/cc)	Temperature (Kelvin)	Pressure (erg/cc)
3.999405e+00	8.554621e+07	1.508347e+16
3.996085e+00	9.972755e+07	1.756982e+16
3.995669e+00	1.162598e+08	2.047958e+16
3.998098e+00	1.355326e+08	2.388768e+16
4.003397e+00	1.580004e+08	2.788285e+16
4.011645e+00	1.841928e+08	3.257046e+16
4.022971e+00	2.147272e+08	3.807590e+16
4.037563e+00	2.503234e+08	4.454855e+16
4.055652e+00	2.918205e+08	5.216686e+16
4.077514e+00	3.401967e+08	6.114450e+16
4.103467e+00	3.965925e+08	7.173774e+16
4.133963e+00	4.623373e+08	8.425628e+16
4.168773e+00	5.389808e+08	9.905707e+16
4.209162e+00	6.283298e+08	1.166046e+17
4.257012e+00	7.324905e+08	1.374893e+17
4.314885e+00	8.539184e+08	1.624709e+17
4.337983e+00	9.954759e+08	1.904357e+17
4.248200e+00	1.160500e+09	2.174431e+17

Table 3: Hugoniot model for LiF based on LEOS L2240

Density (g/cc)	Temperature (Kelvin)	Pressure (erg/cc)
2.640000e+00	2.901112e+02	-2.082824e+04
2.902054e+00	3.382610e+02	8.552539e+10
3.085065e+00	3.944023e+02	1.610919e+11
3.224732e+00	4.598613e+02	2.286857e+11
3.341569e+00	5.361847e+02	2.930016e+11
3.446880e+00	6.251754e+02	3.573680e+11
3.545788e+00	7.289359e+02	4.236769e+11
3.641119e+00	8.499176e+02	4.932619e+11
3.734653e+00	9.909786e+02	5.672540e+11
3.827407e+00	1.155452e+03	6.466494e+11
3.920287e+00	1.347222e+03	7.324789e+11
4.014056e+00	1.570821e+03	8.258562e+11
4.109311e+00	1.831531e+03	9.279603e+11
4.206633e+00	2.135510e+03	1.040190e+12
4.306348e+00	2.489941e+03	1.163954e+12
4.408673e+00	2.903198e+03	1.300956e+12
4.514630e+00	3.385042e+03	1.454981e+12
4.620259e+00	3.946858e+03	1.619855e+12
4.726721e+00	4.601920e+03	1.798472e+12
4.832522e+00	5.365701e+03	1.986702e+12
4.941099e+00	6.256248e+03	2.193401e+12
5.054603e+00	7.294599e+03	2.427069e+12
5.172568e+00	8.505286e+03	2.690044e+12
5.295415e+00	9.916911e+03	2.987889e+12
5.423289e+00	1.156282e+04	3.326052e+12
5.556640e+00	1.348191e+04	3.712011e+12
5.696116e+00	1.571950e+04	4.154679e+12
5.842343e+00	1.832847e+04	4.665017e+12
5.995920e+00	2.137046e+04	5.256432e+12
6.157498e+00	2.491732e+04	5.945624e+12
6.327630e+00	2.905285e+04	6.753173e+12
6.506792e+00	3.387476e+04	7.704185e+12
6.695488e+00	3.949696e+04	8.829578e+12
6.894062e+00	4.605228e+04	1.016766e+13
7.102604e+00	5.369559e+04	1.176613e+13
7.320845e+00	6.260746e+04	1.368374e+13
7.548211e+00	7.299844e+04	1.599223e+13
7.783734e+00	8.511401e+04	1.877884e+13
8.026027e+00	9.924040e+04	2.214973e+13
8.273342e+00	1.157114e+05	2.623522e+13
8.523669e+00	1.349160e+05	3.119281e+13
8.774866e+00	1.573080e+05	3.721350e+13
9.024728e+00	1.834165e+05	4.452892e+13
9.271138e+00	2.138582e+05	5.341777e+13
9.512004e+00	2.493523e+05	6.422045e+13
9.745508e+00	2.907374e+05	7.734768e+13
9.969976e+00	3.389911e+05	9.329448e+13
1.018394e+01	3.952536e+05	1.126611e+14
1.038616e+01	4.608539e+05	1.361683e+14
1.057551e+01	5.373419e+05	1.646813e+14
1.075106e+01	6.265247e+05	1.992399e+14

Density (g/cc)	Temperature (Kelvin)	Pressure (erg/cc)
1.091204e+01	7.305092e+05	2.410800e+14
1.105775e+01	8.517520e+05	2.916653e+14
1.118783e+01	9.931175e+05	3.527309e+14
1.130181e+01	1.157945e+06	4.263002e+14
1.139920e+01	1.350130e+06	5.147145e+14
1.147988e+01	1.574211e+06	6.206865e+14
1.154379e+01	1.835484e+06	7.473063e+14
1.159102e+01	2.140119e+06	8.980607e+14
1.162174e+01	2.495316e+06	1.076866e+15
1.163636e+01	2.909464e+06	1.288075e+15
1.163564e+01	3.392348e+06	1.536502e+15
1.162050e+01	3.955377e+06	1.827516e+15
1.159220e+01	4.611852e+06	2.167095e+15
1.155252e+01	5.377283e+06	2.562011e+15
1.150323e+01	6.269752e+06	3.020086e+15
1.144639e+01	7.310344e+06	3.550377e+15
1.138430e+01	8.523644e+06	4.163639e+15
1.131906e+01	9.938315e+06	4.872659e+15
1.125272e+01	1.158778e+07	5.692587e+15
1.118710e+01	1.351101e+07	6.641487e+15
1.112356e+01	1.575343e+07	7.740616e+15
1.106320e+01	1.836803e+07	9.015014e+15
1.100676e+01	2.141658e+07	1.049405e+16
1.095463e+01	2.497110e+07	1.221199e+16
1.090702e+01	2.911556e+07	1.420891e+16
1.086394e+01	3.394787e+07	1.653152e+16
1.082524e+01	3.958221e+07	1.923422e+16
1.079072e+01	4.615168e+07	2.238047e+16
1.076009e+01	5.381149e+07	2.604420e+16
1.073303e+01	6.274259e+07	3.031150e+16
1.070924e+01	7.315600e+07	3.528283e+16
1.068840e+01	8.529772e+07	4.107518e+16
1.067020e+01	9.945460e+07	4.782490e+16
1.065434e+01	1.159611e+08	5.569099e+16
1.064058e+01	1.352072e+08	6.485874e+16
1.062864e+01	1.576476e+08	7.554412e+16
1.061832e+01	1.838124e+08	8.799896e+16
1.060941e+01	2.143198e+08	1.025168e+17
1.060172e+01	2.498905e+08	1.194398e+17
1.059512e+01	2.913649e+08	1.391671e+17
1.058945e+01	3.397228e+08	1.621637e+17
1.058458e+01	3.961067e+08	1.889718e+17
1.058042e+01	4.618486e+08	2.202238e+17
1.057691e+01	5.385017e+08	2.566578e+17
1.057393e+01	6.278770e+08	2.991328e+17
1.057142e+01	7.320859e+08	3.486508e+17
1.056928e+01	8.535904e+08	4.063796e+17
1.056746e+01	9.952610e+08	4.736809e+17
1.056593e+01	1.160445e+09	5.521433e+17

Table 4: Hugoniot model for LiF based on Lynx 2240

Density (g/cc)	Temperature (Kelvin)	Pressure (erg/cc)
7.502315e+00	1.002694e+05	2.248878e+13
7.825921e+00	1.168914e+05	2.684333e+13
8.157535e+00	1.362690e+05	3.220256e+13
8.495645e+00	1.588588e+05	3.875798e+13
8.834869e+00	1.851935e+05	4.677225e+13
9.165264e+00	2.158938e+05	5.654611e+13
9.477590e+00	2.516834e+05	6.842447e+13
9.764194e+00	2.934059e+05	8.281115e+13
1.001923e+01	3.420450e+05	1.001748e+14
1.023921e+01	3.987472e+05	1.210531e+14
1.042300e+01	4.648491e+05	1.460701e+14
1.057121e+01	5.419090e+05	1.759482e+14
1.068589e+01	6.317435e+05	2.115194e+14
1.077056e+01	7.364701e+05	2.537527e+14
1.083052e+01	8.585578e+05	3.038022e+14
1.087417e+01	1.000884e+06	3.631219e+14
1.091414e+01	1.166805e+06	4.336815e+14
1.096772e+01	1.360231e+06	5.183173e+14
1.105390e+01	1.585722e+06	6.212218e+14
1.118016e+01	1.848593e+06	7.477325e+14
1.133953e+01	2.155042e+06	9.039895e+14
1.150748e+01	2.512292e+06	1.095766e+15
1.165460e+01	2.928765e+06	1.327707e+15
1.175688e+01	3.414278e+06	1.603271e+15
1.180000e+01	3.980277e+06	1.924481e+15
1.178465e+01	4.640103e+06	2.293197e+15
1.172148e+01	5.409312e+06	2.712545e+15
1.162583e+01	6.306035e+06	3.187849e+15
1.151432e+01	7.351412e+06	3.728180e+15
1.139927e+01	8.570085e+06	4.345953e+15
1.128884e+01	9.990783e+06	5.056220e+15
1.118773e+01	1.164700e+07	5.876769e+15
1.109774e+01	1.357776e+07	6.827771e+15
1.101922e+01	1.582861e+07	7.932364e+15
1.095176e+01	1.845258e+07	9.217165e+15
1.089457e+01	2.151153e+07	1.071306e+16

Density (g/cc)	Temperature (Kelvin)	Pressure (erg/cc)
1.084717e+01	2.507759e+07	1.245694e+16
1.080797e+01	2.923480e+07	1.449239e+16
1.077596e+01	3.408117e+07	1.686923e+16
1.075082e+01	3.973094e+07	1.964382e+16
1.073233e+01	4.631730e+07	2.288130e+16
1.071965e+01	5.399551e+07	2.665941e+16
1.071224e+01	6.294656e+07	3.106955e+16
1.071013e+01	7.338147e+07	3.621859e+16
1.071312e+01	8.554621e+07	4.223228e+16
1.072120e+01	9.972755e+07	4.925915e+16
1.073448e+01	1.162598e+08	5.747489e+16
1.075316e+01	1.355326e+08	6.708791e+16
1.077747e+01	1.580004e+08	7.834386e+16
1.080804e+01	1.841928e+08	9.153900e+16
1.084547e+01	2.147272e+08	1.070295e+17
1.088947e+01	2.503234e+08	1.252380e+17
1.094137e+01	2.918205e+08	1.466509e+17
1.100238e+01	3.401967e+08	1.718477e+17
1.107345e+01	3.965925e+08	2.015281e+17
1.115529e+01	4.623373e+08	2.365559e+17
1.124750e+01	5.389808e+08	2.779245e+17
1.135349e+01	6.283298e+08	3.269181e+17
1.147824e+01	7.324905e+08	3.851542e+17
1.162805e+01	8.539184e+08	4.547129e+17
1.168958e+01	9.954759e+08	5.327482e+17
1.146488e+01	1.160500e+09	6.089880e+17