Single crystal elasticity of gold (Au) up to ~20 GPa: Bulk modulus anomaly below ~5 GPa and implication for a primary pressure scale

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We measured single crystal elasticity of gold (Au) as well as its lattice parameters simultaneously under high pressure by using inelastic X ray scattering (IXS) technique. Generated pressure and elastic moduli of gold were obtained only from the present experimental data at five pressure points between 0 and 20 GPa by direct numerical integration. Pressure variation of the bulk modulus displays an anomalous behavior; it is nearly constant up to ~5 GPa, and then steeply increases toward higher pressure. Similar anomaly is observed in independent first-principles calculations as well. The absolute pressure scale determined from the present results gives systematically lower pressures than those from the previous pressure scales owing to the bulk modulus anomaly founded in this study.

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