Many complex materials display an interesting interplay between structural and electronic instabilities, which can be studied effectively under applied pressure. If a continuous structural phase transition is suppressed to low temperatures, as in the quasi-skutterudite system \((\text{Sr/Ca})_3(\text{Ir/Rh})_4\text{Sn}_{13}\) \(^1\), low-energy vibrational excitations can arise that boost superconductivity and cause a linearly temperature dependent electrical resistivity. The aperiodic high-pressure host-guest structure of elemental bismuth displays a similar phenomenology \(^2\), suggesting enhanced phonon spectral weight at low energies (Fig. 1).

It is increasingly desirable to probe the electronic structure near pressure-induced instabilities directly. We have observed the electronic Fermi surface in the correlated metallic state of a pressure-metallised Mott insulator by quantum oscillation measurements in NiS\(_2\) \(^3\) at pressures of up to \(\sim 120\) kbar. Our results show that the Fermi surface remains large on approaching the Mott insulating state, consistent with Luttinger’s theorem, whereas the quasiparticle effective mass is strongly renormalised.

\(^3\) Friedemann, S. et al. Scientific Reports 6, 25335 (2016)

**Fig. 1:** Temperature dependence of the resistivity of the aperiodic high pressure structure of bismuth, Bi-III, which displays type-II superconductivity below a normal state with anomalously strong electron-phonon scattering \(^2\). The resistivity of the conventional strong-coupling superconductor lead, Pb, is given for comparison. The inset illustrates the aperiodic nature of Bi-III along the c-axis.