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Superconductivity in high-pressure solids

JOHN S. TZE, Department of Physics and Engineering Physics, University of Saskatchewan, Saskatoon, SK S7N 5E2, Canada

The structural principle behind the unusual features in the high-pressure phases of simple alkali elements is reviewed. It is shown that there exists a pressure regime in which the elemental solids are likely to adopt a layer structure. There are two novel characteristics associated with this structure type. The system tends to be at the proximity of phonon and electronic instabilities. The combined effect is a significant enhancement of electron-phonon coupling, resulting in a superconducting state. We demonstrate this empirical observation with selected examples including a recently predicted novel structure of high pressure SnH_4 which shows very high superconducting critical temperature.