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Non-BCS superconductivity in fulleride superconductors

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C_{60}-based solids are archetypal examples of molecular superconductors with T_c as high as 33 K. T_c of the face-centered cubic (fcc) A_3C_{60} (A = alkali metal) fullerides increases monotonically with the interC_{60} separation, which is in turn controlled by the sizes of the A^+ cations – this physical picture has remained unaltered since 1992. Pressure-induced trace superconductivity (s/c fraction<<1%) at ∼40 K was reported in 1995 in multiphase samples in the Cs_xC_{60} phase field. Despite numerous attempts by many groups worldwide, this remained unverified and the structure and composition of the material responsible for superconductivity unidentified. This has hindered any attempt to push T_c even higher and make contact with theory which predicts correlation-enhanced superconductivity for expanded fullerides near the metal-insulator transition. Here I will present our recent work in this field that led to the discovery of pressure-induced bulk superconductivity emerging out of a parent antiferromagnetic insulating state at the highest T_c currently known for any molecular material [1,2].

[1] A.Y. Ganin et al. Nature Mater. 7, 367 (2008).
[2] Y. Takabayashi et al. Science 323, 1585 (2009).