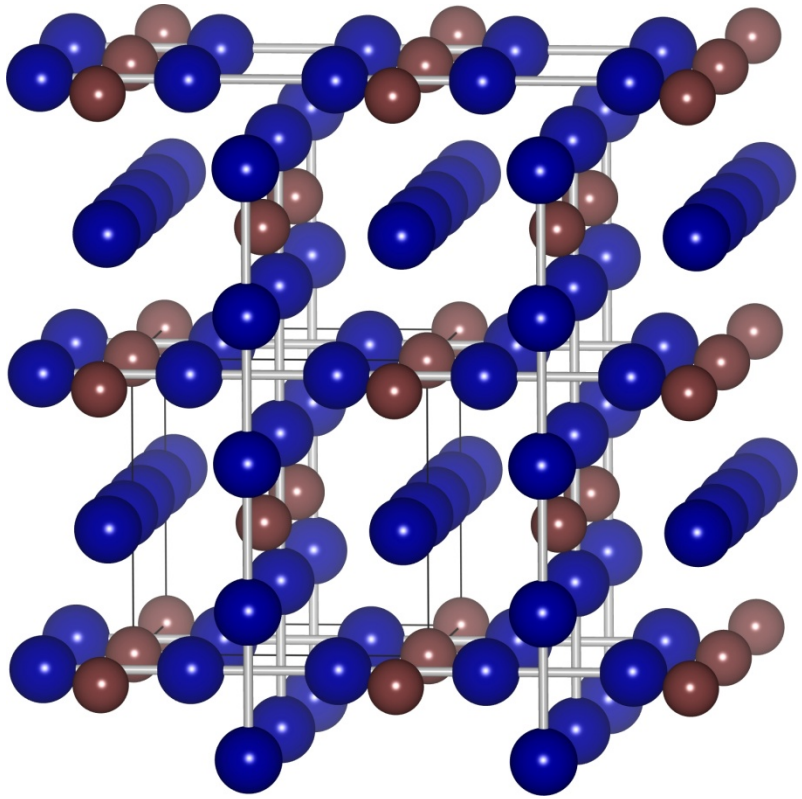
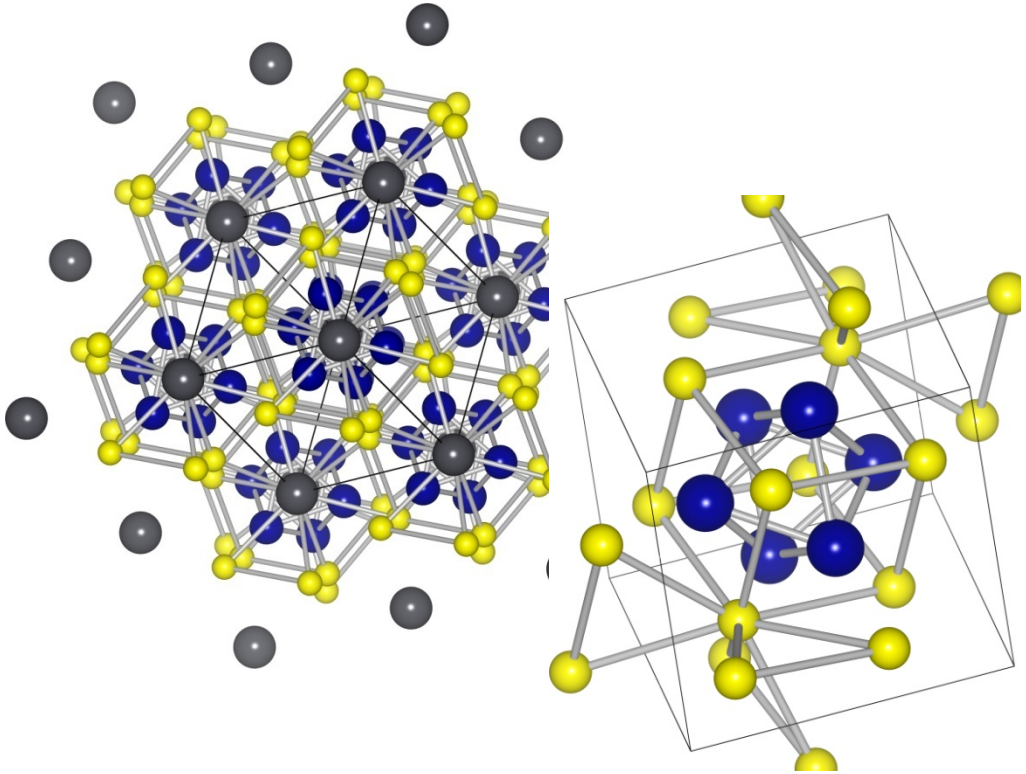
Class 5: Other superconductors

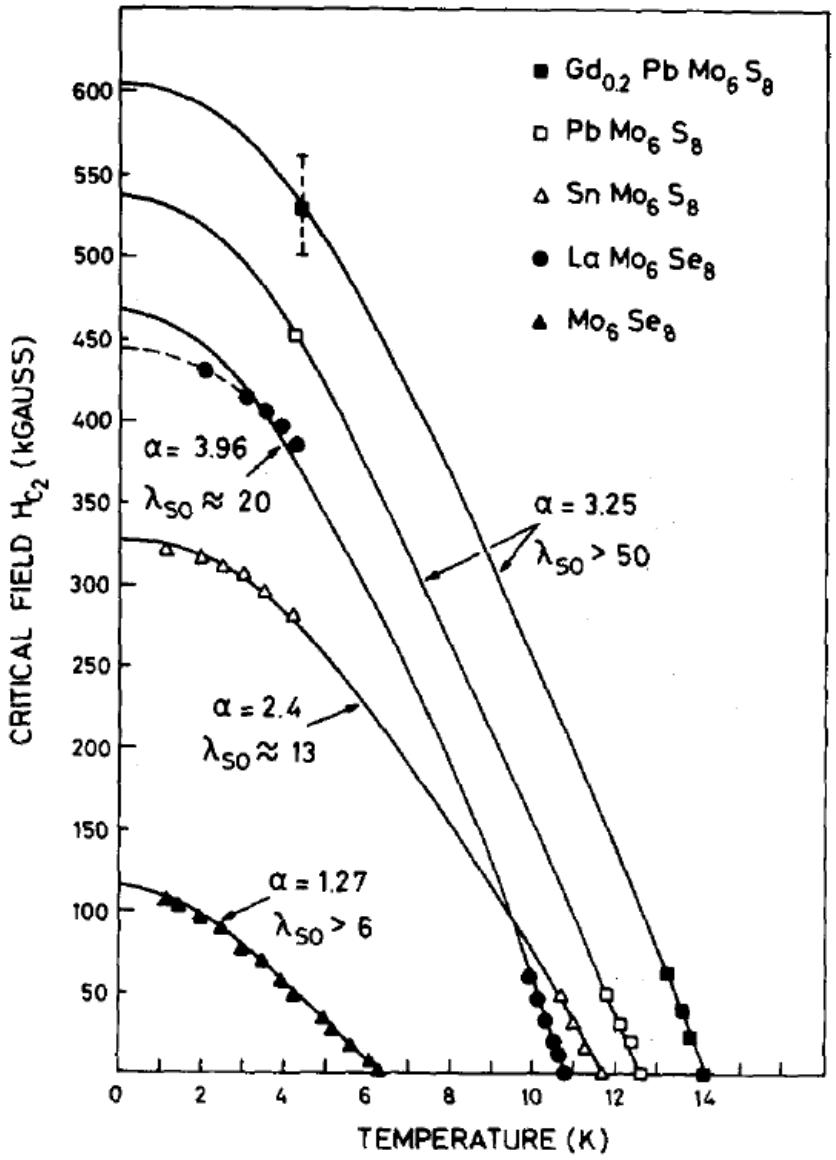


The A-15 compounds: Nb_3Ge, Nb_3Al etc. are still the most widely used materials in magnets. Table from Matthias, *Rev. Mod. Phys.* **35** (1963) 1.

	Superconductivity data			Crystal-structure data	
Compound	T_c °K	T_n °K	References	Lattice constants a,Å	References
Ti_3Sb	5.8		140	5.217	140
Ti_3Ir	5.4		140	5.009	140
Ti_3Pt	0.58		82	5.032	82,150
Ti_3Au		1.20	149		149
V_3Si	17.1		149	4.722	149
V_3Co		0.35	82	4.684	82,151
V_3Ga	16.5		112,152	4.816	152
V_3Ge	6.01		149		149
V_3As		1.02	112	4.74	112
V_3Rh	0.38		82	4.784	82,153
V_3Sn	7.0		154	4.94	154
	3.8		144	4.96	144
V_3Sb	0.80		82	4.941	82,136,152
V_3Ir		0.35	82	4.786	82,136,163
$(V_{2.67}Ir_{0.33})Ir$	1.39		140	4.794	140
V_3Pt	2.83		140	4.814	140
V_3Au	0.74		82	4.883	82,155
Cr_3Si		1.20	149		149
Cr_3Ga		0.35	82	4.645	82,152
Cr_3Ge		1.20	149		149
Cr_3Ru	3.3		111		111
Cr_3Rh		0.30	111		111
$Cr_{0.85}Ir_{0.15}$	0.77		111		111
Cr_3Pt		0.30	111		111
Zr_3Au	0.92		82	5.483	82,136,137
Zr_3Pb	0.76		82	5.656	82
Nb_3Al	17.5		152	5.187	152
	16.8–18.0		156, a		156, a
Nb_3Ga	14.5		152	5.171	152
Nb_3Ge	6.90		82	5.166	82,136,157
Nb_3Rh	2.50		112	5.115	112
Nb_3In	9.2		158	5.303	158
Nb_3Sn	18.05		159,160	5.289	154
Nb_3Sb		1.02	112,152	5.262	152
Nb_3Os	1.05		112	5.121	154
Nb_3Pt	9.2		154	5.153	154
Nb_3Ir	1.7		154	5.131	154
Nb_3Au	11.5		155	5.21	155
Mo_3Al	0.58		82	4.950	82,152
Mo_3Si	1.30		149		149
Mo_3Ga	0.76		82	4.943	82,152
Mo_3Ge	1.43		149		149
Mo_3Os	7.2		27		27
Mo_3Ir	8.35; 8.8		25; 27	4.974	82,161,162
$Mo_{0.74}Ir_{0.26}$	9.05		141	4.972	141
Ta_3Sn	6.0		154,159	5.276	154
	6.4		144	5.278	144

Class 5: Other superconductors

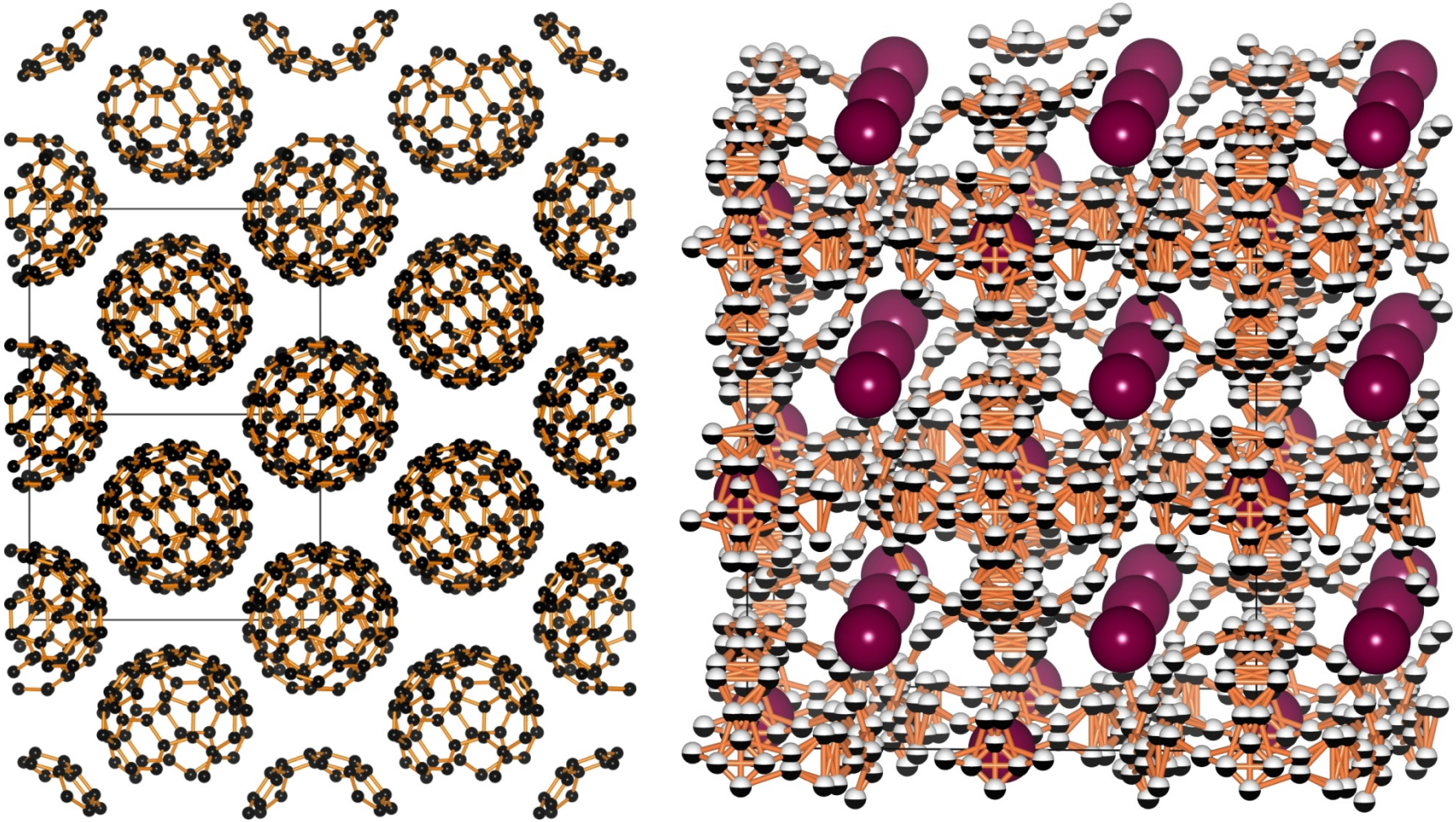




The Chevrel phases (R. Chevrel, Université de Rennes)

These compounds have a very high H_{c2} some other unusual properties such as magnetism co-existing with superconductivity.

Class 5: Other superconductors



Ordered C_{60} (left) and K_3C_{60} (right)

Superconductivity in the Fullerenes

C. M. VARMA, J. ZAANEN, K. RAGHAVACHARI

Intramolecular vibrations strongly scatter electrons near the Fermi-surface in doped fullerenes. A simple expression for the electron-phonon coupling parameters for this case is derived and evaluated by quantum-chemical calculations. The observed superconducting transition temperatures and their variation with lattice constants can be understood on this basis. To test the ideas and calculations presented here, we predict that high frequency H_g modes acquire a width of about 20% of their frequency in superconductive fullerenes, and soften by about 5% compared to the insulating fullerenes.

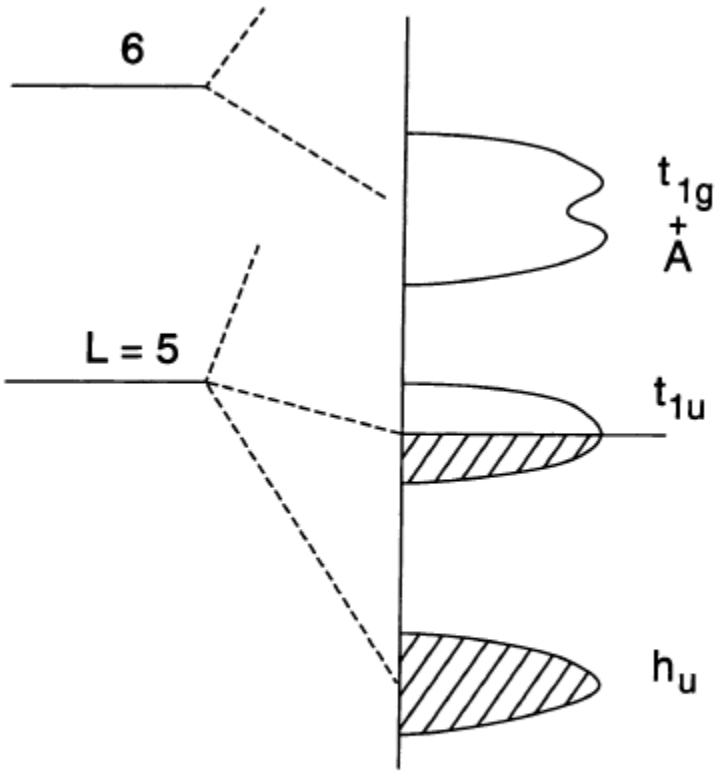


Fig. 1. Artists conception of the electronic structure of the fullerenes, as inferred from photoemission spectroscopies and electronic structure calculations. *A* denotes the alkali *s* level.

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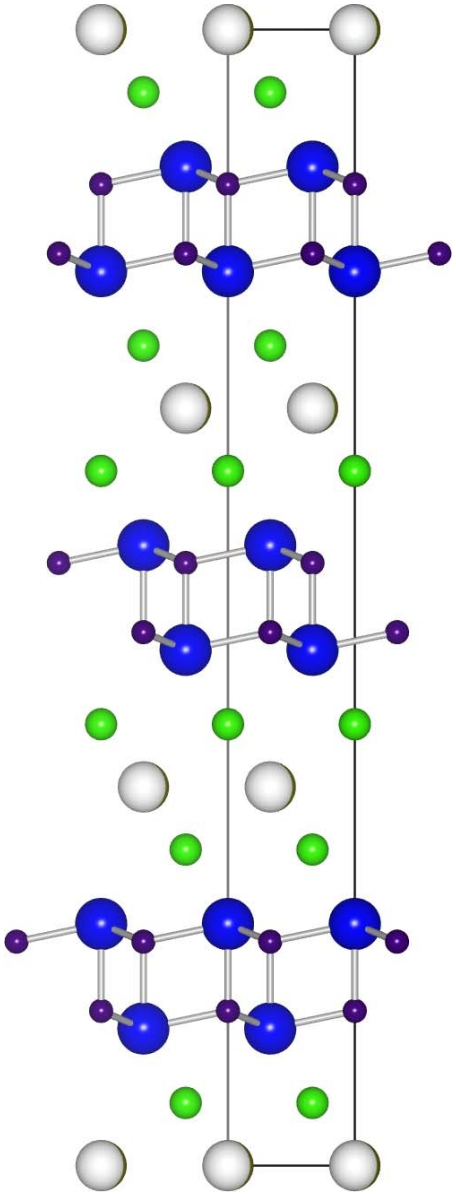

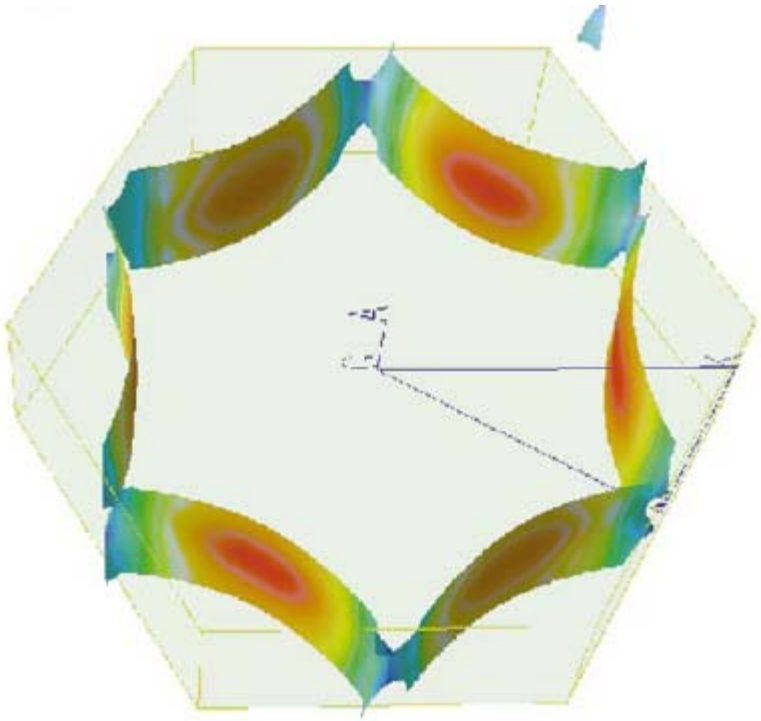

The hexagonal double honeycomb compounds $Li_x[HfNCl]_2$. The Fermi surface at optimal doping resembles the High T_c cuprates.

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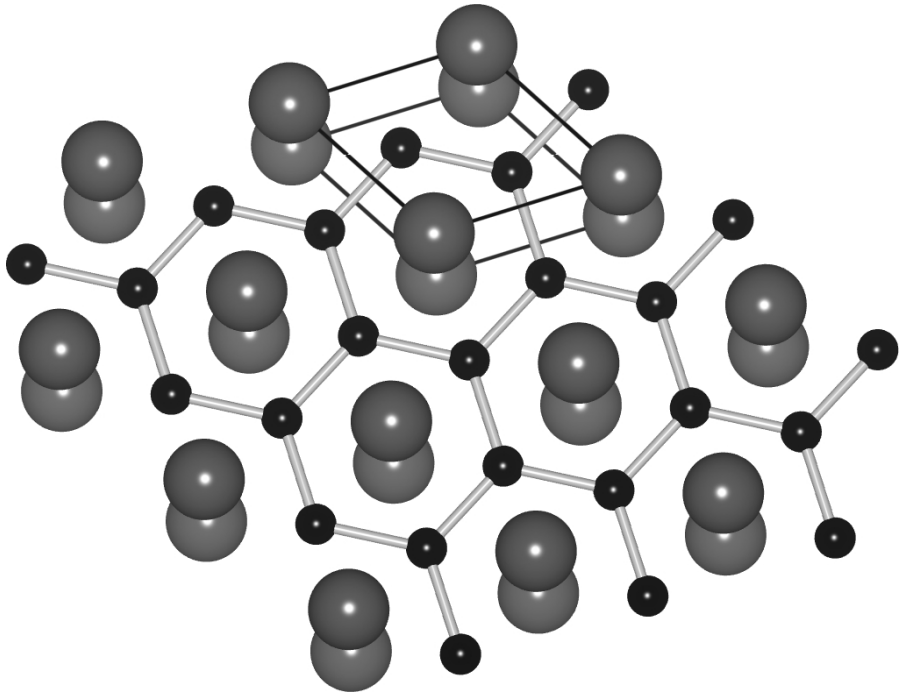

From Floris *et al. Phys Rev. Lett.* **94** (2005) 037004.

MgB_2 is isoelectronic and nearly isostructural with graphite. Its an electron-phonon superconductor with T_c near 30 K.

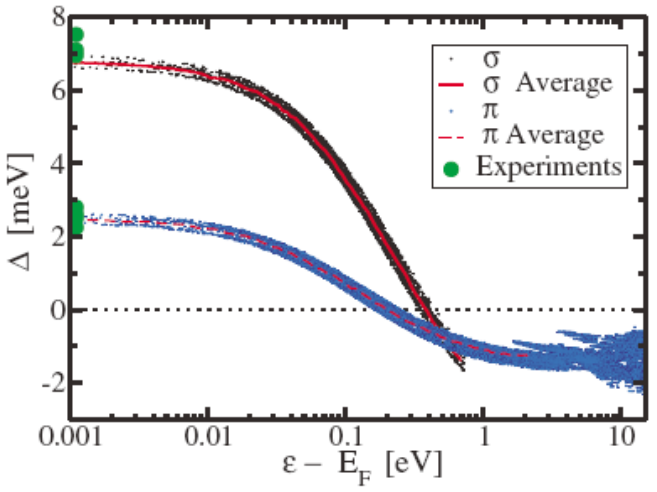

FIG. 1 (color). Calculated superconducting gap of MgB_2 as a function of energy ($T = 0$ K).

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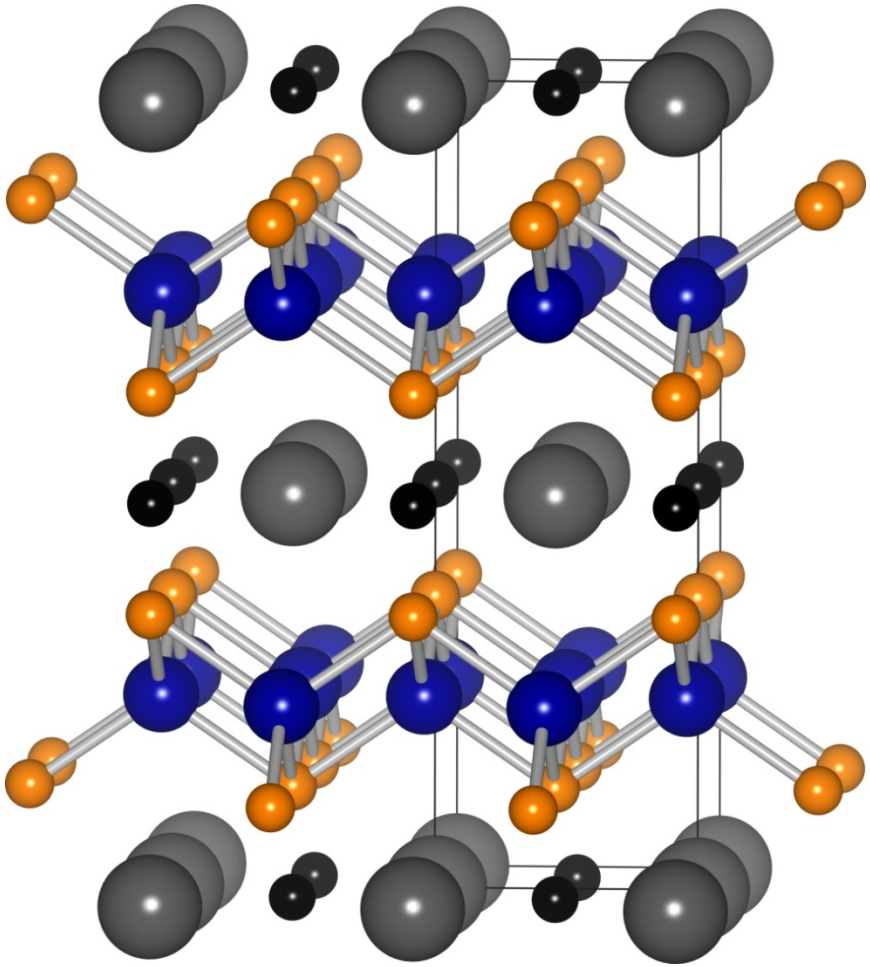

$Lu_2Ni_2B_2C$ with a stuffed $ThCr_2Si_2$ structure is a family of superconductors with maximum T_c near 20 K.

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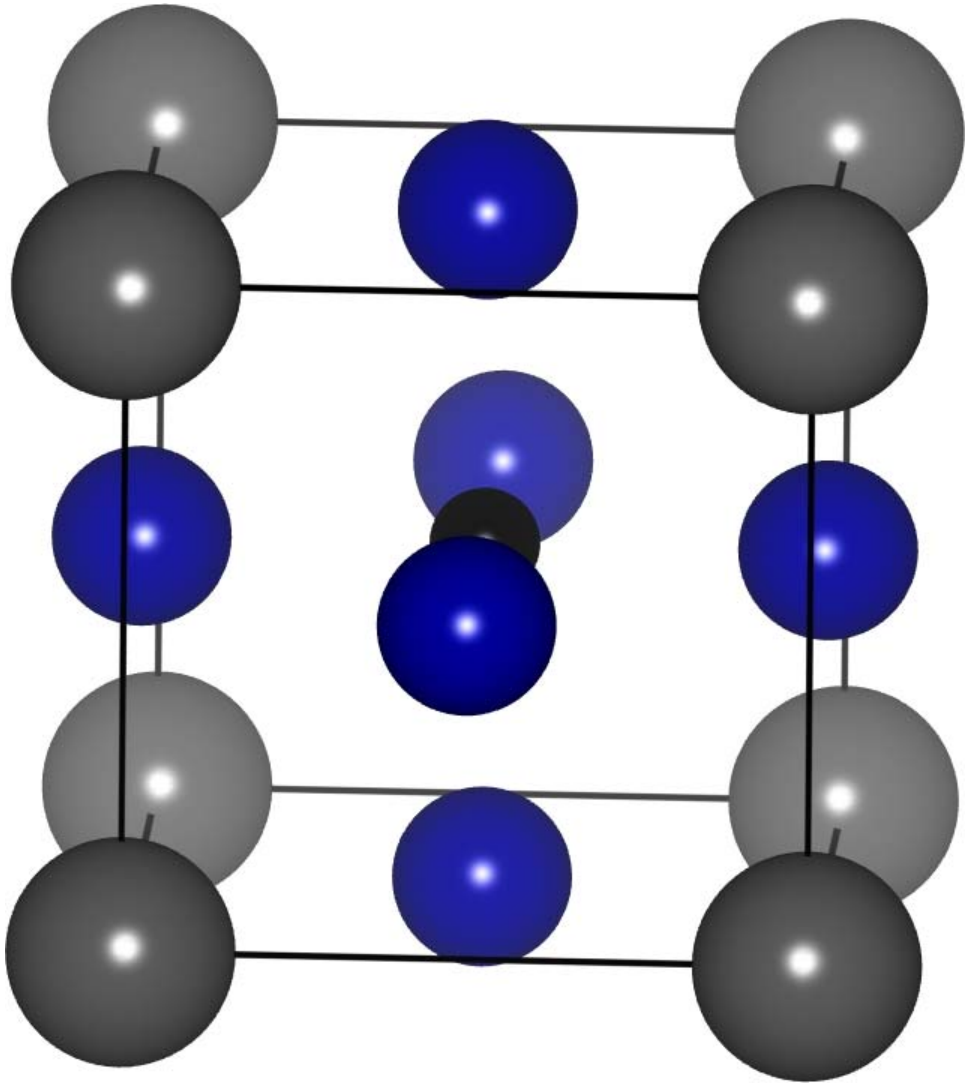

$MgNi_3C$

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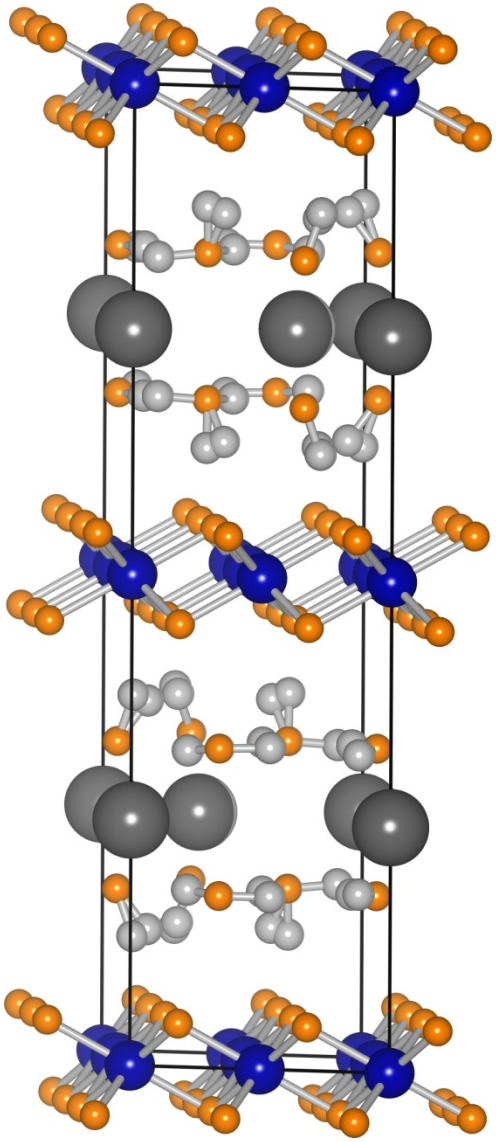

Layered cobaltates: Add water !