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Iron-based superconductivity induced by topotactic insertion of light elements (H, O, F) in the LaFeSi intermetallic

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Iron-based superconductors (IBSC) are usually made of building blocks containing iron atoms associated to a pnictogen or chalcogen element (P, As and S, Se, Te respectively)[1]. However, we have recently discovered the first IBSC containing "FeSi" as conductive layer, i.e. the silicide-hydride LaFeSiH ( $T_c=10\text{K}$ ) obtained by solid-gas hydrogenation of LaFeSi [2]. This finding has motivated the research of new IBSC by topotactic intercalation of light elements, like O or F, in intermetallics. However, fluorine and oxygen insertion has remained elusive so far since the strong reactivity of these atypical elements, the most electronegative ones, tends to produce the chemical decomposition of intermetallic compounds.

In this talk, I will present the superconductors we obtained by topochemical synthesis routes and, in particular, I will introduce a new method to intercalate fluorine atoms into intermetallics, using perfluorocarbon reactant with covalent C-F bonds. This novel approach is very efficient to synthesize mixed anion (Si-F) LaFeSiF<sub>x</sub> single-crystals in which we observe the coexistence of ionic and metallo-covalent blocks in interaction through inductive effects [3]. Interestingly, we show the emergence of superconductivity across this series, as well as in LaFeSiO<sub>1-δ</sub>, that thus extends the family of IBSC to novel FeSi-based materials beyond the conventional ferropnictides and chalcogenides [3,4].

#### References

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