Emergence of superconductivity in doped H_2O ice

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In my talk I will show that for realistic levels of doping, the covalent phase X of ice becomes superconducting with a critical temperatures of about 60 K under pressure. The throughout of the investigation points out to the possibility of achieving high-temperature superconductivity in hydrides under pressure by inducing metallization of otherwise insulating phases through doping, a path previously used to render standard semiconductors superconducting at ambient pressure. We have taken H_2O as testbed, one of the most abundant and well-studied substances in the universe, and identify nitrogen as the most likely and promising substitution/dopant. Furthermore, I will discuss a possible path to reach the synthesis of the nitrogen doped ice-X and the superconducting state, which consists in starting from a similar synthesis to what is used to obtain H_2+H_2O clathrates, and then induce defect oxygen vacancies at moderate pressures. In view of the vast number o f hydrides that are strongly covalent bonded, but that remain insulating up to rather large pressures, our results open a series of new possibilities in the quest for the so dreamed room-temperature superconductor.