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SUPERCONDUCTING HYPE: ON SOUTH KOREA'S LK-99

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Unlike most other developments in the field of condensed-matter physics, every new claim of room-temperature superconductivity will monopolise headlines worldwide and kick up tremendous hype. Late last month, researchers in South Korea announced — via two preprint papers uploaded to the arXiv repository — that they had found a material they called LK-99 to be a superconductor at room temperature and ambient pressure. Conventional superconductors (i.e., those whose superconducting abilities can be explained by the Bardeen-Cooper-Schrieffer theory) are distinguished by four features, one of which has implications for industrial, research, and diagnostic applications that are impossible to overstate: they can transport an electric current with zero loss. Scientists have been looking for a material that can superconduct without having to be cooled to very low temperatures and which does not require the application of extreme pressure. According to the new claim, LK-99 fits the bill. It is copper-substituted lead apatite. While there have been quite a few claims in the last century of scientists having discovered room-temperature superconductors, LK-99 has triggered more excitement, presumably because the group's preprint papers are free to access, include some data pointing in the right direction, and contain instructions to synthesise it and test its properties.

In a coincidental irony, 'apatite' is derived from the Greek 'to deceive'. All the claims of scientists having found a room-temperature (and ambient pressure) superconductor so far have failed to withstand independent scrutiny. A room-temperature and -pressure superconductor is an immensely valuable thing, attached to significant material as well as scientific prestige. This could prompt scientists to rush to publish their results before proper data verification. Thus, independent verification by qualified scientists becomes crucial — for which the South Korean group must share all the data. Checking if a material is a superconductor is difficult, requiring sophisticated equipment as well as information about how precisely to create the material in question. For another claim this year, of a material that reportedly superconducts near room temperature and under much less pressure than others of its kind, its originators shared instructions to synthesise it but refused to share samples, claiming they constituted intellectual property. While this may be, their refusal vitiated the proper process of science in the face of such an extraordinary claim. Finally, despite the lucre of a potentially revolutionary technology, and bearing in mind that the margin of error in superconductivity research is very small, non-experts should wait for independent verification, even if it is slow to come, from a qualified research group before making up their mind about it.

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