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Magnetic nature of wolframite $MnReO_4$

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Rhenium oxide compounds of the type $AReO_4$ where A is a first-row transition metal cation, exhibit interesting electronic properties. Among this family of compounds, $MnReO_4$ was the first of this kind, synthesized with a high-pressure technique at 25 kbar in 1970 **[1]**. It has a wolframite structure where both cations have partially filled d shells, and an anisotropic electrical resistivity that makes it suitable for potential applications in the development of electrical devices **[2]**. Although this material was already known for several years, the magnetic properties of $MnReO_4$ have never been studied in detail. In this work we present the very first investigation of the magnetic nature of the wolframite insulator $MnReO_4$ carried out by muon spin rotation. The aim of the experiment was to clarify the occurrence a static antiferromagnetic order, and the possibility for the formation of magnetic multipole order at low temperatures, which is expected due to the lack of an inversion symmetry at the Re6+ site and a strong spin-orbital coupling of its 5d1 electron. The occurrence of the static antiferromagnetic ordering was clearly observed in $MnReO_4$ and the order parameter of the transition was determined.

[1] A. W. Sleight, Inorg. Chem. 14, 597 (1975).
[2] A. W. Sleight, United States Patent, 4027004 (1977).

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