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**Exotic magnetic structures in high-pressure synthesized perovskites.** PASCAL MANUEL, DMITRY KHALYAVIN, LEI DING, STFC Rutherford Appleton Laboratory, ISIS Pulsed Neutron Facility, United Kingdom, WEI YI, Institute of Physics and Beijing National Laboratory for Condensed Matter Physics, China and National Institute for Materials Science, Tsukuba, Japan, YU KUMAGAI, Materials Research Center for Element Strategy, Tokyo Institute of Technology, Japan, FUMIYASU OBA, Laboratory for Materials and Structures, Institute of Innovative Research, Tokyo Institute of Technology, Japan, FABIO ORLANDI, STFC Rutherford Appleton Laboratory, ISIS Pulsed Neutron Facility, United Kingdom, ALEXEI BELIK, International Center for Materials Nanoarchitectonics and Research Center for Functional Materials, National Institute for Materials Science, Japan — We present a neutron powder diffraction study of the crystal and magnetic structures of the high-pressure stabilized perovskite phases of  $TlMnO_3$ ,  $ScCrO_3$ ,  $InCrO_3$  and  $TiCrO_3$ . These compounds exhibit original magnetic structures compared to other members of their respective manganite and orthochromite families with  $TlMnO_3$  also displaying unusual orbital ordering pattern. For both systems, we rationalise the structures through a combination of group theory and first principle calculations. We also highlight the dominant mechanism controlling the spin direction as being the single ion anisotropy.

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