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## Critical fluctuations in the layered ruthenates $\text{Ca}_2\text{RuO}_4$ and $\text{Ca}_3\text{Ru}_2\text{O}_7$

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Materials realizing the scaling behavior of the XY model in two dimensions (2D) are sparse. Here we report on comprehensive neutron triple-axis measurements conducted at the FRM2, BER2, and ILL to investigate the critical static and dynamical magnetic fluctuations in the layered ruthenates  $\text{Ca}_2\text{RuO}_4$  (CRO214) and  $\text{Ca}_3\text{Ru}_2\text{O}_7$  (CRO327). Specifically, we probe the temperature-dependence of the antiferromagnetic (AFM) Bragg-intensity, the  $Q$ -width, the amplitude, and the energy-width of the magnetic diffuse scattering in vicinity to the Neel temperature  $T_N$  to determine the critical behaviour of the magnetic order parameter  $M$ , correlation length  $\xi$ , susceptibility  $\chi$ , and the characteristic energy  $\Gamma$ . We find that - in spite of distinct magnetic structures - the critical behaviours of CRO214 and CRO327 follow similar universal scaling laws that are compatible with predictions of the 2D-XY model. Hence, our results suggest that single- and bilayer ruthenates provide new platforms to study the 2D-XY model in solid-state materials.

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