THz and infrared excitation spectrum below the Jahn-Teller transition in Sr$_3$Cr$_2$O$_8$

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— We report on optical excitations observed recently in Sr$_3$Cr$_2$O$_8$ by THz and infrared spectroscopy. Low-energy excitations below 3 THz are detected by THz time domain spectroscopy. These excitations can be divided into two different classes according to the temperature-dependent properties. One is emergent right below the Jahn-Teller transition temperature, which is determined by specific heat measurement to occur at 285 K [1, 2]. The other appears only below 100 K, where the fluctuations are sufficiently suppressed, consistent with the temperature dependence of low-energy Raman modes [3]. Infrared transmission measurements reveal a broad crystal-field excitation, which can be associated with an electronic transition from E to T$_2$ orbital states.