Hearing the Local Orientability of Orbifolds. Sean Richardson ‘20, Liz Stanhope,
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Given some object, such as a drum, there exists a spectrum of fundamental frequencies determined by physics. However, if the drum was in a neighboring room and you could only listen to these frequencies, is it possible to deduce the drum’s shape? In other words, “Can you hear the shape of a drum?”. In this research project, we ask a similar question but for abstract mathematical objects. The vibrational frequencies for abstract objects correspond to the eigenvalue spectrum of the Laplace operator associated to the object.

The abstract shapes we study are called orbifolds. An orbifold is a multidimensional object that is allowed to have some “trouble spots,” which are tied to the symmetries allowed in n-dimensional space. We ask: Given the Laplace spectrum of an unknown orbifold, what properties of the orbifold are determined? We show that one can hear the local orientability of an orbifold. That is, we can use the Laplace spectrum to detect trouble spots associated to orientation reversing symmetries of n-dimensional space.