

Shot Noise in NbN Distributed Superconducting Tunneling Junctions

Dong Liu^{1,2,3}, JieHu^{1,2,3}, Ming Yao^{1,2,3}, Jing Li^{1,2}, and Sheng-Cai Shi^{1,2*}

¹PurpleMountain Observatory, CAS, 2 West Beijing Road, Nanjing, 210008, China

²Key Laboratory of Radio Astronomy, CAS, 2 West Beijing Road, Nanjing, 210008, China

³GraduateSchool of ChineseAcademy of Sciences, 19 Yuquan Road, Beijing, 10040, China

*E-mail: scshi@pmo.ac.cn

With sensitivity approaching the quantum limit, superconductor-insulator-superconductor (SIS) mixers play an important role in radio astronomy and atmospheric research at millimeter and sub-millimeter wavelengths. As one of the intrinsic noise sources in superconducting tunneling junctions, shot noise is still not well understood, particularly for SIS junctions of relatively high energy gap (e.g., NbN/AlN/NbN). In this paper, we mainly study the shot noise of three different NbN junctions (i.e., parallel connected twin junctions, distributed junction array and long junction) as well as its temperature dependence. It has been found that the shot noise increases with temperature in general, while the fraction due to the MAR effect is inversely proportional to temperature. In addition, the tunnel barrier transmission in superconducting junctions is found to be nearly independent of temperature. Detailed measurement results and analysis will be presented.