

# **Qualifying Exam Questions**

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**What are thermal noise and quantum noise in physical systems? You can choose any one of the following systems and describe the origins of those fluctuations.**

- 1. Simple macroscopic conductor**
- 2. Mesoscopic conductor under ballistic regime**
- 3. pn junction under either forward or reverse bias**
- 4. Tunnel junction**
- 5. Laser/maser**
- 6. Parametric oscillator**
- 7. Mechanical oscillator**
- 8. Bose-Einstein condensation**