**Advanced Laboratory**

**Dept. of Physics & Astronomy**

**Stony Brook University**

**Pre-experiment and mid-experiment evaluation sheet**

You must meet with a staff member for the experiment you are doing before beginning an experiment and before the lab period indicted in the middle of the experiment for an evaluation of your preparation and your progress to date. This form must be signed and dated by the staff member to indicate you have done the required work to date. It must be attached as the first page of your report. You will lose one grade point from your report grade for each section of this form that is not properly signed on time. If this is your first experiment you should also be prepared to demonstrate you have read and understood the information on log books in the course notes.

**Phase Transitions:**

**Metal-Insulator transition in VO2 and**

**Ferroelectric transition in BaTiO3**

**Student name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Partner name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Pre-lab discussion:**

Be prepared to demonstrate you have read the background material for this experiment (most of this material is contained this write-up, but also in cited references; it includes theory described in Appendix 1). Discuss the following questions with the staff:

1. Describe what we mean by *phase transitions*; give some examples; what is the difference between phase transitions of the *first* and *second* kind? Experimentally, in this lab, how can we tell which transition is it?
2. Give a general description of a *metal-insulator* transition; what happens to the electronic spectrum of a solid when this transition takes place? What is the most direct manifestation of this transition, and how can it be detected? Is this transition taking place all at once in the whole sample, or not (explain)?
3. Explain what is *ferroelectricity* and what is the mechanism for it in BaTiO3

4. What does a PID controller do? Be specific about its principle of operation.

5. What is the general principle of operation of a Lock-in amplifier?

Completed before first period for the experiment? Yes/No

Staff comments\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Staff signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_