**Project Proposal: Dual-Path for the Student LIGO Project at CFI, IITM**

The **Student LIGO Project at CFI, IIT Madras** is working toward building a **suspended Fabry-Perot Michelson Interferometer** in collaboration with IUCAA. The long-term goal is to develop a system where **each mirror is suspended and controlled in all 6 degrees of freedom**.

Currently, **two single-stage suspensions** have been provided by IUCAA. The remaining suspensions will arrive once the initial setup, and suspension control is acquired. However, the **supporting electronics and control systems are still pending**, including:

* PCI - Express cards
* Data acquisition system (Desktop ETS Controller)
* SIM9B2, SIM900 modules
* PCB design and testing setups

These purchases will take time, creating a gap where involved students have limited hands-on work and not much to show at the Research Conclave and Open House presentations.

**Proposed Two-Fold Approach:**

**1. Long-Term Goal (5-Year Plan):**

Complete a **suspended Fabry-Perot Michelson interferometer** with full suspension control for the 6 DOFs per mirror. This system will use advanced DAQ and control infrastructure.

**2. Immediate Goal (6–12 Months):**

Build a **small table-top Michelson interferometer** in parallel. This will:

* Provide fast, hands-on learning for students
* Teach control filter design, noise analysis, and feedback control
* Use **Red Pitaya** for prototyping, despite its I/O limitations for large systems
* Serve as a practical training ground for the FPMI system

**Hardware Requirement for Table-Top Michelson:**

| **Item** | **Qty** | **Cost (₹)** |
| --- | --- | --- |
| Mirrors | 4 | 10,000 |
| Beamsplitter | 1 | 5,000 |
| PZT + Mount | 1 | 5,000 |
| Red Pitaya | 1 | 30,000 |
| **Total** |  | **50,000** |

If a **Nd:Yag** **laser and photodetector** can be arranged from existing stock, the additional costs are minimal.

**Conclusion**

This dual-path approach ensures continuous learning while waiting for long-term components. The **table-top Michelson interferometer** will provide quick results, keep students engaged, and help develop the skills needed for the suspended FPMI.

We request a **budget of ₹50,000** for the required optical components and a Red Pitaya.