**Undergraduate Research Project**

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| **Project Name:** | **Notions of Positivity and Complexity in Quantum Information Theory** | **Number of Positions:** | 1-2 |
| **Supervisor:** | Thomas Sinclair | | |
| **Supervisor e-mail:** | tsincla@purdue.edu | | |
| **Project Description:** | We will let Mk denote the algebra of k-by-k complex matrices. A k-by-k matrix is positive semidefinite if it is equal to its conjugate transpose and all eigenvalues are non-negative. Linear transformations from Mn to Mk which send positive semidefinite matrices to positive semidefinite matrices are central objects of study in quantum information theory. In this project we will study some related notions of positivity for linear transformations between matrix algebras and attempt to understand their complexity in terms of whether such linear transformations can be used to compute computationally hard problems. | | |
| **Final Deliverables:** | A poster or slide presentation. Published research is possible if significant results are obtained. | | |
| **Weekly Working Hours** | Students should plan on devoting 5-10 hours per week to the project. | | |
| **For Credits/Voluntary** | Voluntary | | |
| **Desired Qualifications** | Required: Linear algebra  Preferred: Coding experience with Python. Some exposure to proof-based mathematics | | |

**If you are interested in participating in this research project, please send an e-mail to the supervisor e-mail listed above together with a resume, a list of what courses you’ve taken or a copy of your transcript, and a personal statement explaining why you are interested in this project.**