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- For my project, I think a lot about 4d hyperkähler ALE spaces:
  - ALE stands for "asymptotic locally Euclidean".
  - For each finite subgroup $\Gamma < SU(2)$, there is an ALE space X_Γ corresponding to Γ, and $X_\Gamma \cong \widetilde{\mathbb{C}^2/\Gamma}$.
  - ALE spaces are first classified by Kronheimer in his thesis. He constructs them through a hyper-kähler reduction on a finite dimensional vector space.
  - Relation with the McKay Correspondence:

    For a finite subgroup $\Gamma < SU(2)$, the blowup diagram obtained by resolving the singularity of $\mathbb{C}^2/\Gamma$ is the same as the McKay quiver of Γ, i.e, the irreducible representations of Γ correspond to the irreducible components of the exceptional set when resolving the singularity.
- What I did is to give a new gauge-theoretic construction of these spaces, realizing each of them as a moduli space of solutions to a system of equations, modulo a hyperkähler gauge group action.
- Future directions include extracting new insights on the McKay Correspondence via the new gauge-theoretic construction, generalizing this construction to get more hyperkähler spaces, etc.

Other things I'd like to learn more and think about include:

- Open book decompositions, Lefschetz fibrations, and contact structures
- Heegaard Floer homology, knot floer homology
- Instanton Floer homology
- Seiberg-Witten theory
- Hitchin's work on self-duality equations
- Trisections