Post Mindmap Exercise

Inspired by your mind-mapping, outline your next steps. Immediate (and perhaps intermediate) goals for yourself. A lot of detail isn't needed here, or time-line. We will get to time-management plan in the next week or so. Just write out what scholarly-type (or other?) work you want to dive into next. And provide a very brief rationale for how each particular detail fits into a broader plan.

- Literature you want to search
- Fundamental physics you want to start looking into
- Software tools or other analysis tools you think you might want to look into
- Other ? (your project might include broad areas not included above)

Be succinct and as specific in your plan as you can. Keep it to 200-300 words.

My next step is to deepen my understanding of how electromagnetic noise, particularly biomagnetic noise and human-generated electromagnetic pollution affects the radical pair mechanism, since this directly connects quantum spin dynamics to real-world environmental impacts. I plan to begin with the paper *Robustness of the avian compass function described by a radical pair model against biomagnetic noise*, and then expand to literature on broadband EM interference, spin relaxation, coherence times, and experimental studies of animal disorientation under urban EM sources. This will help with realistic noise rates and parameter ranges for modeling. Alongside this, I have to build a foundation with linear algebra, differential equations, the Schrodinger equation, and particularly constructing and interpreting Hamiltonians for spin systems. Computationally, I plan to use Python with QuTiP to simulate radical pair evolution and coherence decay through Jupyter Notebooks for visualization and documentation. Currently, I am intermediate at Python, but have not used QuTiP prior to this, so that is something I will begin working on as well. Additionally, I am interested in exploring different aspects of this mechanism including entropy reduction, sensor physics, and failure conditions where the mechanism breaks down. Potentially investigating whether differences in radical pair lifetimes or coherence times could explain why some species are more vulnerable to EM pollution than others could also be interesting. Together, these steps should support my interest in a computation study addressing potential questions such as under what noise rates sensitivity peaks and how different frequency bands of broadband EM noise affect compass precision.