Topological Quantum Computing

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A theoretical model known as a Topological Quantum Computer (TQC) was the subject of my research for the AMSI scholarship. TQCs promise to be as fast and able as other theoretical models for Quantum computers, but without the drawback of errors caused by quantum decoherence. The stability of a TQC arises from the use of 2-dimensional particles known as anyons which can be manipulated in a way that resembles mathematical braids. These anyons would form the logic gates of a computer, and their topological invariance under certain conditions makes them immune to the kind of errors other quantum computers would be prone to.

The aim of my research was to be able to outline how Quantum computers in general, and TQCs specifically, would theoretically operate. Ultimately it was the contrast between the TQC and other models that was the most interesting aspect, as the potential for this emerging field of computing is incredible.

My research involved an extensive review of literature on the subject, particularly papers written by pioneers in the field like Shor, Freedman and Kitaev. However, I also found that articles from mainstream science media sources sometimes proved useful for their clarity or for their use of other sources I had not found elsewhere.

The AMSI scholarship was an invaluable opportunity to gain experience both in research, under the guidance of my supervisor Prof. Andrew Francis at UWS, and in presenting my findings to my peers at CSIRO's Big Day In.

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See: www.ice-em.org.au/vs09.html