



QUANTUM COMPUTING ON BOTH SIDES

Some observations

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Mitglied der Helmholtz-Gemeinschaft



WHO AM I AND WHY AM I GIVING THIS TALK?

Biographical notes

- Working on quantum computing (theory around superconducting qubits) since 1999
- Habilitation in 2004
- Then a career-killer in Germany - but more established in North America
- My first trip to Canada was my job interview - Waterloo then beat an offer of UCSD
- Faculty appointment as Assoc. Prof. University of Waterloo (IQC + Physics/Astro) from 2006-2011
- Formative years: First independent teaching, first full responsibility for group
- Returned after my kids were diagnosed with strong disability and it became clear we could not stay
- Full Prof. At Saarland since 2011, Institute director at Jülich since 2020
- Active in the flagship: Early coordination action, project coordination

Note: Personal flavour, Waterloo- Germany biased, 10 years old



UNIVERSITÄT
DES
SAARLANDES



CANADA STARTED EARLY IN QUANTUM

Establishment of institutes

- Early 2000s Europe: Some basic science project plus EU-FET projects - community unclear if it was a fad
- Canada started IQC Waterloo (2002), IQST Calgary (2006), CIFAR program quantum information science (2002), Perimeter Institute (1999), CQIQC Toronto (2004)
- Strong collaboration between mathematics and physics based on some elements of the British „Theory is done in maths“ tradition
- Good involvement of engineering by more American attitude to applied physics
- Academic teaching with early start and now strong experience in teaching quantum
- Amazing network of alumni



COMMUNITY AND ACTORS

Big country, with half of Germany's population

- Strong emphasis on Universities (all public)
- Three groups - Medical-doctoral, comprehensive, primarily undergraduate / liberal arts style
- Less aggressive advertising than, e.g., the US
- Some great talents starts at small universities ... because they grew up there (St. Francis-Xavier, Winnipeg, Lakehead, Memorial ...)
- Diverse graduate student population, large Iranian and Egyptian communities
- Key RTOs such as the National Research Council



CANADIAN COLLEAGUES

Where do they come from

- Similar to the US: Faculty positions usually not endowed
- Different from the US: NSERC discovery grants program provides operating grants
- Canadian Institute for Advanced Research program to bring them together
- Canada research chairs - External endowment beyond discovery grants
- Superstar programs - e.g. Canada Excellence Research Chairs (David Cory, Bertrand Reulet)
- Super-place programs - e.g. Canada First Research Excellence Funds (TQT Waterloo, IQ Sherbrooke)
- 10 years ago, people perceived a mid-career problem
- Strong emphasis on industry partners
- Provincial programs

RETURNING TO EUROPE

Seeing your home with somewhat Canadian eyes

- Traditional teaching attitude (teach topic once right, fail large portion of students) - resilient and independent graduates
- Variety of academic systems - Europe is not just one country (Bologna notwithstanding), e.g. France / Germany
- Large ecosystem of research and technology organizations (Germany - MPG, Helmholtz, Fraunhofer, Leibniz; France - CNRS, CEA; Italy - CNR etc.) complementing university research



QUANTUM IN EUROPE

Energetic move of 500 Mio people

- National programs accelerating since 2014 and still new ones getting started
- Support through EU by established means since approx. 2000
- Transition to applied research: Flagship launch in 2018 + national programs
- Strong push to market from the start on
- Strong user industry - multitude of high-tech industries
- Strong toolmaker industry
- Various PPP models - also as viable career paths

