# Top 10 Quantum Qabalim of Qontrol

1. Quantum control is the method of the future: Always has been, always will be.
2. This conference has sent me out of control (Ruhman)
3. If quantum control can't hit one out of the park, we'll make the park smaller! (Bucksbaum)
4. Have field but still no yield? Blame it on the bandwidth (Levis)
5. If you wait long enough, there is no phase control with one photon (Weinacht)
6. No Phase? No problem! (Sussman)
7. After 4 billion years of evolution all we get is a surfer? (Miller)
8. Next to these pulses, Duane's are puny (Sension).
9. Don't judge a molecule by its orientation (Stapelfeld).
10. Grand Challenge: Quantum sexing (Silberberg).
11. Safed 2013 theme: Ytterbium quantum control! (Elan Shochat)
12. A chicken is an egg's way of making another chicken (Silberberg).
13. Optimization doesn't give you the wrong state; you picked the wrong target.
14. There are no evolutionary algorithms, just states that quantum control has allowed to live
15. Genetic algorithms: the last book of the Old Testament. ("Reb" Rabitz)
16. Mount Rabitz – but it's not the tallest hill in the landscape. (Kosloff)
17. Paul Brumer once thought he was wrong – but he was mistaken.
18. Best new coherent phenomenon of the meeting: dark requests (Shapiro)

# Experimental challenges / wishlist
# What is common?

- The scientific field is diverse – good!
- The electric fields are diverse – good!
- The language is diverse – …?!
- We share common technology… this can keep us together

# Experimental challenges / wishlist
# Femtosecond pulse shaping

- Broad bandwidth across spectrum
  - X-Ray / XUV: indirect
  - UV: difficult to obtain broadband
  - VIS: dealing with dispersion remains challenging
  - IR: direct shaping starting to become available
  - THz
- Time window from as to ms
  - Time resolution ~ 1/bandwidth: Coherent addition of regimes?
  - Maximum window ~ # shaping parameters: individual comb-line shaping?
- Vectorial degrees of freedom
  - Phase, amplitude, polarization: 4 parameters for transverse field all „at will“ @ molecule
  - Longitudinal field adds 2 more components
- Spatial degrees of freedom
  - Angular and/or spatial resolution (below diffraction limit)
- Acquisition protocols
  - shot-to-shot updating for fast scanning schemes
  - how to deal with artefacts

# Experimental challenges / wishlist
# Control basis / parameters

- Often-used parameters
  - Taylor coefficients of spectral phase
  - sine phase
  - triangular phase
  - binary phase
  - phase jump
  - time-frequency representations

We have individual results in various systems.

We may consider these parameterizations as a “toolbox”.

Should we establish a “database” of control results à la NIST?

# Experimental challenges / wishlist
# Still missing…

- Combine many control scenarios with alignment and orientation
- Control of chirality and stereochemistry
- Control of bimolecular reactions
- Selective bond breaking and making in liquids
- Systematic combination with (multidimensional) spectroscopies
- Various detection techniques
  - X-ray
  - diffraction
  - …
- What's bugging you?

## Coherent Control Challenges – Experimental

- More studies on systems of intermediate complexity are needed.
  (for example, small polyatomic molecules)

- What is the future role of the feedback-control learning-loop "technique" ?

  Is it mainly another tool in the tool box of coherent control (i.e., helps to get the "proper" signal) or is it (or can be) much more ?

  How can we learn from learning algorithms ?

  *[ I think there are not too many examples of understanding the control mechanism in polyatomic molecules (???)]*