Research opportunities in Accelerator Physics

Georg Hoffstaetter, ERL accelerator group

Superconducting Energy Recovery Linac (in construction)
Domains of accelerator types

**Synchrotron:** Repetitive acceleration to high energy, low repetition rate and therefore low current.
High energy, low current, relatively large beam size ➔ Fixed target experiments,

**Storage rings:** Rare filling at high energy and storage for millions of turns, high current, requires very low loss rates.
High energy, high current, relatively large beam size ➔ Internal target experiments

**Linacs:** Linear acceleration to moderately high energies that are limited by the available length. Current*Energy is limited by the available power.
Moderately high energies, low current, small beam size ➔ Fixed target experiments, moderately

Cornell’s 12GeV Synchrotron
And
Cornell’s storage ring CESR
Energy Recovery Linacs (ERLs)

- Produce beam powers, and currents typical of synchrotrons. simultaneously
- Produce beam quality (density and brightness) of linacs.

Store energy in superconducting cavities while using electrons once.
High-Power ERL to prototype Nuclear-Physics colliders and FELs

- Existing world record high brightness linac
- Existing world record DC electron gun
- New high-current linac
- Existing beam stop

Superconducting Energy Recovery Linac (in construction)

- 6 MeV
- +/- 36 MeV
- 42, 78, 114, 150 MeV
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<th>Research Area</th>
<th>Examples</th>
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<td>Single particle nonlinear dynamics</td>
<td>coupler kick</td>
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<td>(ex. of undergrad honors thesis)</td>
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<td>Multi particle beam dynamics</td>
<td>intra beam scattering</td>
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<td>Coherent effects, i.e. of many particles together (PhD)</td>
<td>Coherent Synchrotron Radiation</td>
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<td>Interaction of the beam and environment (PhD)</td>
<td>wake fields</td>
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<td>Accelerator design, planning, construction, and operation</td>
<td>the Cornell FFAG ERL</td>
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Building a High-Power ERL accelerator at Cornell

Existing world record high brightness linac
Existing world record DC electron gun
New high-current linac
Existing beam stop

6 MeV

 +/- 36 MeV

42, 78, 114, 150 MeV

Superconducting Energy Recovery Linac (in construction)
Conclusion

• Help us design, build, study and operate this new kind of particle accelerator.

• ERL group meeting: Thursdays, 4pm, 383 Wilson lab (WebEx meeting with collaborators at Brookhaven National Laboratory)