Monte Carlo simulation of the CUPID array

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Electron Phonon Interaction

CUPID experiment

Heading

- Statement
- Explanation
- Example

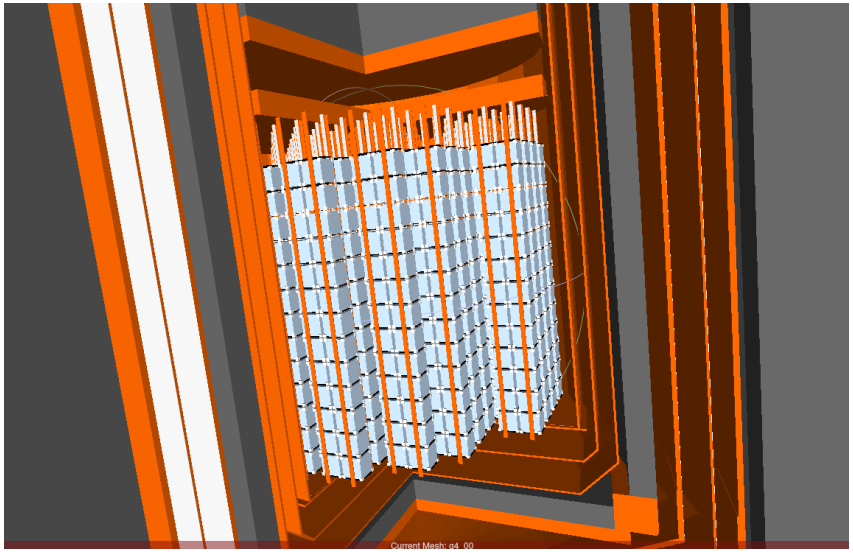

Figure: rendering of proposed CUPID array of Li_2MoO_4

Context

Superconductivity was discovered in 1911 by Kammerlingh Onnes at the University of Leiden. It has held physicists' interest both in experiment and theory because of its remarkable features: near dissipationless conduction, magnetic field rejection, and macroscopically observable quantum variables. It would then take nearly *half of a century* for the first microscopic description of superconductivity to be devised, the Bardeen-Cooper-Schrieffer theory (1957). This theory is based on very clever assumptions regarding the ground state wavefunction of the electrons in a weakly attractive potential.

As early as 1950, physicists had strong reasons to believe that this attractive potential was driven by the interaction of electrons with vibrations in the metallic lattice (phonons).

Simultaneous with the formulation of the BCS theory, several russian physicists would lay the ground work for an alternative microscopic description of superconductivity in the language of a

Field Operators

$$\hat{\Psi}_\alpha = \sum_{q,\sigma} \hat{a}_{q,\sigma} u_{q,\sigma} e^{-iq\cdot x} \tag{1}$$

$$\hat{\varphi} = \sum_{p<p_M} a_p \left(b_p e^{-ip\cdot x} + b_p^\dagger e^{+ip\cdot x} \right) \tag{2}$$

- For superconductors, we only consider electrons as they are responsible for the interaction we are interested in
- phonons have typical normal mode decomposition with cutoff due to the lattice spacing. This is just a real scalar field.
- Nulla commodo, erat quis gravida posuere, elit lacus lobortis est, quis porttitor odio mauris at libero
- Nam cursus est eget velit posuere pellentesque
- Vestibulum faucibus velit a augue condimentum quis convallis nulla gravida

Which Hamiltonian?

$$\hat{H}_{BCS} = \sum_{q,\sigma} \hat{a}_{q,\sigma} u_{q,\sigma} e^{-iq\cdot x} \tag{3}$$

$$\hat{H}_{F}rolich = \sum_{p<p_M} a_p \left(b_p e^{-ip\cdot x} + b_p^{\dagger} e^{+ip\cdot x} \right) \tag{4}$$

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Blocks of Highlighted Text

Block 1

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Block 3

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Multiple Columns

Heading

1. Statement
2. Explanation
3. Example

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Table

Treatments	**Response 1**	**Response 2**
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table: Table caption

Theorem

Theorem (Mass–energy equivalence)

$E = mc^2$

Verbatim

Example (Theorem Slide Code)

```
\begin{frame}
\frametitle{Theorem}
\begin{theorem}[Mass--energy equivalence]
$E = mc^2$
\end{theorem}
\end{frame}
```

Figure

Uncomment the code on this slide to include your own image from the same directory as the template .TeX file.

Citation

An example of the `\cite` command to cite within the presentation:

This statement requires citation [Smith, 2012].

References

John Smith (2012)

Title of the publication

Journal Name 12(3), 45 – 678.

The End