

# THREE-BODY RECOMBINATION OF COLD ATOMS

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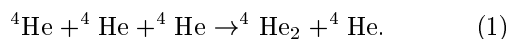
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Three-body recombination processes are one of the main factors limiting the achievable density and lifetime of current generation Bose-Einstein condensates (BECs). Such processes are also important in nuclear physics and chemical dynamics.

In the present work, we shall study three-body recombination of cold helium atoms:



This study extends previous work<sup>1</sup> where *ultra*-cold alkali atoms were treated. An extra difficulty comes from the fact that not only zero total angular momentum  $J = 0$  states, but also  $J > 0$  states should be taken into account because of their higher binding energy.

We will use a modified version of Smith-Whitten hyperspherical coordinates<sup>2</sup>. Using these coordinates, one can easily introduce the symmetrization effects for three identical bosons, so that the configuration space can be reduced by a factor of 3. Coupled equations in an adiabatic hyperspherical representation are then solved using the variational  $R$ -matrix method.

The interaction used is a sum of helium dimer potentials from A.R. Janzen and R.A. Aziz<sup>3</sup>.

Our goal is to calculate the "event rate constant"

$$K_3 = \frac{\hbar k}{\mu} \sigma, \quad (2)$$

or the "recombination length"

$$\varrho_3 = (\mu K_3 / \hbar)^{1/4}, \quad (3)$$

where  $\sigma$  is the cross section for three-body recombination,  $\mu$  is the three-body reduced mass.

## References

1. B.D. Esry et al., Phys. Rev. Lett., **83**, 1751 (1999)
2. B.K. Kendrick et al., J. Chem. Phys., **110**, 6673 (1999)
3. A.R. Janzen and R.A. Aziz, J. Chem. Phys., **103**, 9626 (1995)

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