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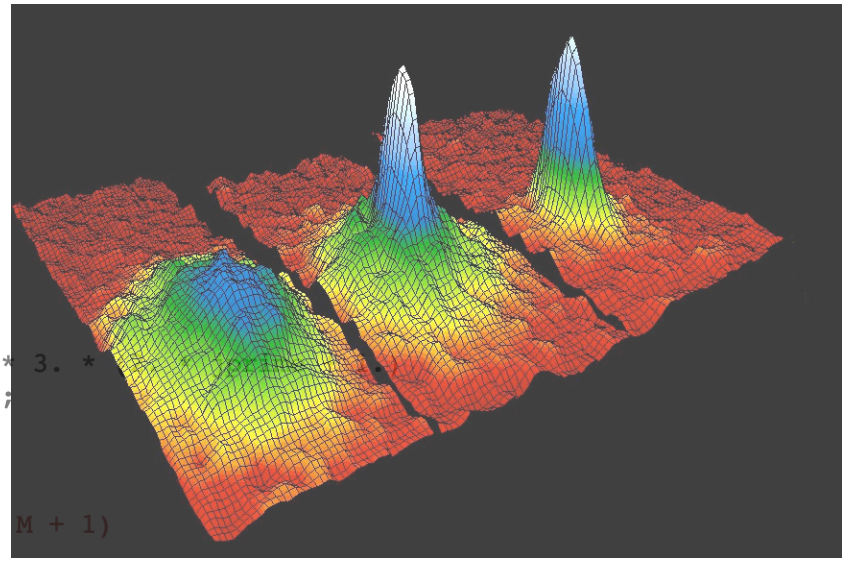
Atomic and Molecular Physics & Computational Physics

My research focuses mainly on numerical simulations of atomic and molecular systems, governed by quantum mechanics. A current topic of interest is the simulation of Bose-Einstein condensates.

The simplest theoretical model describing Bose-Einstein condensates is the Gross-Pitaevskii equation (GPE), which is a non-linear Schrödinger equation, the non-linearity coming from the particle-particle interaction. Opportunities exist for the projects aimed at developing numerical methods for the GPE.

Good programming skills are a must. Knowledge of Matlab, C or C++ is required.



```
for (int j = 0; j < Jmax; ++j)
  {
    jprime = j + 1;

    fac = factor * sqrt ((2. * j + 1.) * 3. *
                         / (4. * M_PI));

    for (int m = -j; m <= j; ++m)
      {
        // Coupling with Y_{1,-1} (M' = M + 1)
        mprime = m + 1;
        H->coupling_mm[1][Cindex(j,m)] = pow (-1., m) * fac
          * gsl_sf_coupling_3j (2 * j, 2, 2 * jprime, 0, 0, 0)
          * gsl_sf_coupling_3j (2 * j, 2, 2 * jprime, -2 * m, -2, 2 * mprime);

        // Couplings with Y_{1,0} (M' = M)
        H->coupling_m0[1][Cindex(j,m)] = pow (-1., m) * fac * M_SQRT2
          * gsl_sf_coupling_3j (2 * j, 2, 2 * jprime, 0, 0, 0)
          * gsl_sf_coupling_3j (2 * j, 2, 2 * jprime, -2 * m, 0, 2 * m);

        // Couplings with Y_{1,1} (M' = M - 1)
        mprime = m - 1;
        H->coupling_mp[1][Cindex(j,m)] = pow (-1., m) * fac
          * gsl_sf_coupling_3j (2 * j, 2, 2 * jprime, 0, 0, 0)
          * gsl_sf_coupling_3j (2 * j, 2, 2 * jprime, -2 * m, 2, 2 * mprime);
      }
  }
```