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In[154]:= ParticleTimeSeries[d_, n_] :=
Module[
  {dir = d, name = n},
  file = dir <> "/txt_stack/" <> name <> ".txt";
  particles = Import[file, "Table"];
  nparticles = Differences[Position[particles, "t", 2]][[1, 1]] - 1;
  dt = particles[[2 + nparticles, 3]];
  particlesT = Partition[particles[[2 ;;]], nparticles, nparticles + 1];
  {nparticles, dt, particlesT}
];

MSD[d_, n_, nl_] :=
Module[
  {dir = d, name = n, nlags = nl},
  {nparticles, dt, particlesT} = ParticleTimeSeries[dir, name];
  nt = Length[particlesT];
  msds = Table[{(t - 1) * dt,
    Mean[
      Catenate[
        Table[
          SquaredEuclideanDistance[
            particlesT[[t + lag, i, 1 ;; 2]], particlesT[[1 + lag, i, 1 ;; 2]]
          , {i, 1, nparticles}, {lag, 0, nt - t, Ceiling[(nt - t) / nlags]}
        ]
      ]
    }],
    {t, 1, nt}
  ];
  msds
];

In[135]:= mdwout = "/Volumes/homes/Code/cytomod/shila/semiflexible/out/network/";

In[5]:= dts = {".00001", ".00004", ".00007", ".00010",
  ".00040", ".00070", ".00100", ".00400", ".00700", ".01000"};
dtdirs = Table["sticky_clnk_rigid_dt" <> dt, {dt, dts}];

In[136]:= newmsds = Table[MSD[mdwout <> dtdirs[[i]], "rods", 50], {i, 2, Length[dts]}}];

In[168]:= Length[newmsds]

Out[168]= 9

In[169]:= msds = Table[
  Table[
    {newmsds[[t, i, 1]], Mean[newmsds[[t, i, 2]]]},
    {i, 1, Length[newmsds[[t]]]}],
  {t, 1, Length[newmsds]}}];

In[160]:= msd1 = MSD[mdwout <> dtdirs[[1]], "rods", 50];

In[176]:= msds = Insert[msds, msd1, 1];

In[178]:= Length[msds]

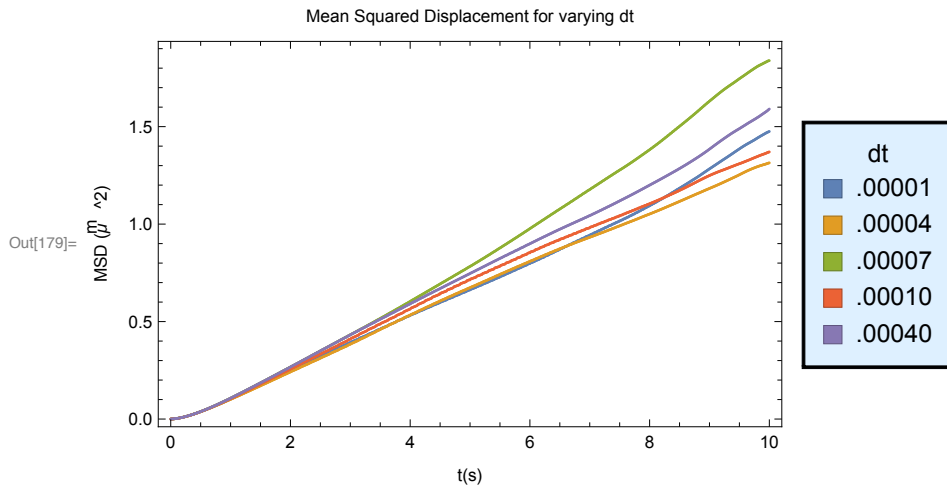
Out[178]= 10

```

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In[179]:= ListPlot[msds[[1 ;; 5]], Frame → True,
  FrameLabel → {"t(s)", "MSD ( $\mu\text{m}^2$ )", "Mean Squared Displacement for varying dt"},
  PlotLegends → SwatchLegend[dts, LegendLabel → "dt",
    LegendFunction → (Framed[#, Background → LightBlue] &)]
]

```



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In[180]:= InterpFs =
  Table[
    ListInterpolation[msds[[i, All, 2]], msds[[i, All, 1]]],
    {i, 2, Length[dts]}
  ];

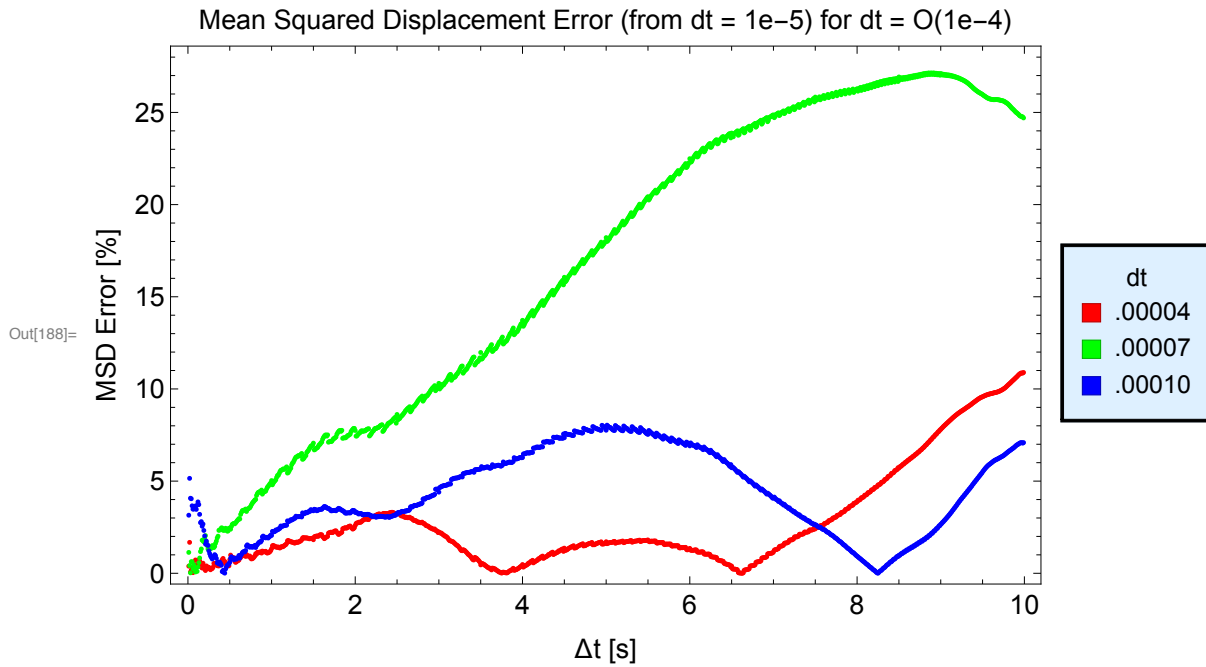
In[181]:= errs =
  Table[
    Transpose[
      {msds[[1, 2 ;; -2, 1]],
        Abs[
          Map[InterpFs[[k - 1]], msds[[1, 2 ;; -2, 1]]] - msds[[1, 2 ;; -2, 2]]
        ]
      ] / msds[[1, 2 ;; -2, 2]] * 100
    ],
    {k, 2, Length[dts]}
  ];

```

```

In[188]:= ListPlot[errs[[1 ;; 3]], Frame -> True,
  PlotStyle -> {Red, Green, Blue}, FrameLabel -> {" $\Delta t$  [s]", "MSD Error [%]",
    "Mean Squared Displacement Error (from  $dt = 1e-5$ ) for  $dt = O(1e-4)$ "},
  PlotLegends -> SwatchLegend[{Red, Green, Blue}, dts[[2 ;; 4]],
    LegendLabel -> "dt", LegendFunction -> (Framed[#, Background -> LightBlue] &)],
  BaseStyle -> {FontSize -> 14}
]

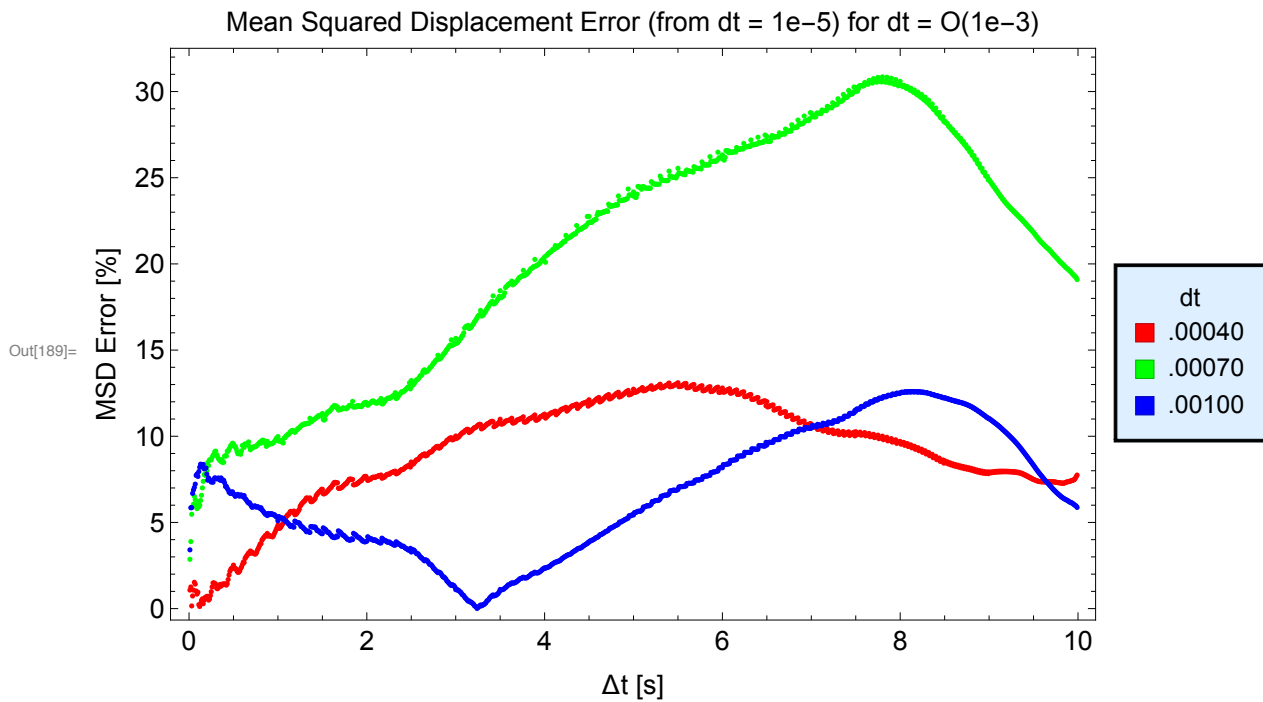
```



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In[189]:= ListPlot[errs[[4 ;; 6]], Frame -> True,
  PlotStyle -> {Red, Green, Blue}, FrameLabel -> {" $\Delta t$  [s]", "MSD Error [%]",
    "Mean Squared Displacement Error (from dt = 1e-5) for dt = O(1e-3)"},
  PlotLegends -> SwatchLegend[{Red, Green, Blue}, dts[[5 ;; 7]],
    LegendLabel -> "dt", LegendFunction -> (Framed[#, Background -> LightBlue] &)],
  BaseStyle -> {FontSize -> 14}
]

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In[190]:= ListPlot[errs[[7 ;; 9]], Frame -> True,
  PlotStyle -> {Red, Green, Blue}, FrameLabel -> {" $\Delta t$  [s]", "MSD Error [%]",
    "Mean Squared Displacement Error (from  $dt = 1e-5$ ) for  $dt = O(1e-2)$ "},
  PlotLegends -> SwatchLegend[{Red, Green, Blue}, dts[[8 ;; 10]],
    LegendLabel -> "dt", LegendFunction -> (Framed[#, Background -> LightBlue] &)],
  BaseStyle -> {FontSize -> 14}
]

```

