

## Methods for understanding the angular scattering of chemical reactions

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### Introduction

The attached slides were presented at the meeting held in honour of Professor Antonio Laganà's 70<sup>th</sup> birthday and his formal retirement from the University of Perugia, Italy. The meeting was entitled, *Virtual Environments and Detailed Simulations of Molecular Processes*, and was held in Bettona, near Perugia, Italy, 4<sup>th</sup> – 5<sup>th</sup> November, 2015. The slides are in two parts:

1. The first part shows the eleven papers that arose from Antonio's research when he was a postdoctoral research associate with me at the University of Manchester during the late 1970s.

2. The second part describes several modern techniques for analysing and understanding the angular scattering of state-to-state reactions. Topics discussed are:

- Outline of Nearside-Farside (NF) theory.
- Outline of Local Angular Momentum (LAM) theory.
- Semiclassical glory scattering for chemical reactions.
- Semiclassical rainbow scattering for chemical reactions.
- Regge pole and complex angular momentum theory applied to reactions
- Examples are presented for the following three state-to-state chemical reactions:
  - $F + H_2 \rightarrow FH + H$ ,
  - $CH_4 + Cl \rightarrow CH_3 + HCl$ ,
  - $S(^1D) + DH \rightarrow SD + H$ .