

Figure 8. from Chemistry of the High-mass Protostellar Molecular Clump IRAS 16562–3959

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|                                  | HNCO        | OCS         | H <sub>2</sub> CCO | CH <sub>3</sub> OH | SO          | CH <sub>3</sub> CHO | SiO         | C <sup>33</sup> S | HCS <sup>+</sup> | c-C <sub>3</sub> H <sub>2</sub> | H <sup>13</sup> CO <sup>+</sup> | CH <sub>3</sub> C <sub>2</sub> H | 3mm         | CH <sub>3</sub> C <sub>3</sub> N | CH <sub>2</sub> CHCN | CCH         | HN <sup>13</sup> C | NH <sub>2</sub> D | HC <sub>3</sub> N | HC <sub>5</sub> N | H <sup>13</sup> CN |
|----------------------------------|-------------|-------------|--------------------|--------------------|-------------|---------------------|-------------|-------------------|------------------|---------------------------------|---------------------------------|----------------------------------|-------------|----------------------------------|----------------------|-------------|--------------------|-------------------|-------------------|-------------------|--------------------|
| HNCO                             | 1.00        | <b>0.69</b> | 0.51               | 0.64               | 0.46        | 0.55                | 0.48        | 0.30              | 0.32             | 0.13                            | 0.21                            | 0.15                             | 0.14        | 0.11                             | 0.09                 | 0.19        | 0.39               | 0.13              | 0.35              | 0.21              | 0.40               |
| OCS                              | <b>0.69</b> | 1.00        | <b>0.60</b>        | <b>0.75</b>        | <b>0.71</b> | 0.58                | 0.61        | 0.54              | 0.45             | 0.20                            | 0.39                            | 0.36                             | 0.34        | 0.22                             | 0.18                 | 0.30        | 0.45               | 0.10              | 0.52              | 0.34              | 0.53               |
| H <sub>2</sub> CCO               | 0.51        | <b>0.60</b> | 1.00               | 0.59               | 0.37        | 0.59                | 0.29        | 0.32              | 0.34             | 0.20                            | 0.32                            | 0.26                             | 0.35        | 0.17                             | 0.23                 | 0.22        | 0.39               | 0.13              | 0.39              | 0.34              | 0.42               |
| CH <sub>3</sub> OH               | 0.64        | <b>0.75</b> | 0.59               | 1.00               | 0.61        | <b>0.72</b>         | 0.51        | 0.40              | 0.37             | 0.14                            | 0.38                            | 0.33                             | 0.34        | 0.23                             | 0.08                 | 0.29        | 0.53               | 0.17              | 0.61              | 0.29              | 0.58               |
| SO                               | 0.46        | <b>0.71</b> | 0.37               | 0.61               | 1.00        | 0.36                | <b>0.66</b> | <b>0.64</b>       | 0.49             | 0.27                            | 0.48                            | 0.51                             | 0.39        | 0.36                             | 0.16                 | 0.36        | 0.49               | 0.09              | 0.61              | 0.35              | 0.62               |
| CH <sub>3</sub> CHO              | 0.55        | 0.58        | 0.59               | <b>0.72</b>        | 0.36        | 1.00                | 0.37        | 0.30              | 0.31             | 0.12                            | 0.25                            | 0.15                             | 0.14        | 0.04                             | 0.01                 | 0.22        | 0.39               | 0.11              | 0.37              | 0.23              | 0.41               |
| SiO                              | 0.48        | 0.61        | 0.29               | 0.51               | <b>0.66</b> | 0.37                | 1.00        | 0.34              | 0.24             | 0.20                            | 0.26                            | 0.33                             | 0.15        | 0.16                             | 0.09                 | 0.28        | 0.40               | 0.03              | 0.52              | 0.27              | 0.40               |
| C <sup>33</sup> S                | 0.30        | 0.54        | 0.32               | 0.40               | <b>0.64</b> | 0.30                | 0.34        | 1.00              | <b>0.62</b>      | 0.35                            | 0.47                            | 0.49                             | 0.34        | 0.34                             | 0.11                 | 0.42        | 0.47               | 0.05              | 0.54              | 0.41              | 0.59               |
| HCS <sup>+</sup>                 | 0.32        | 0.45        | 0.34               | 0.37               | 0.49        | 0.31                | 0.24        | <b>0.62</b>       | 1.00             | 0.37                            | 0.36                            | 0.39                             | 0.24        | 0.16                             | 0.06                 | 0.54        | 0.50               | 0.11              | 0.39              | 0.37              | 0.41               |
| c-C <sub>3</sub> H <sub>2</sub>  | 0.13        | 0.20        | 0.20               | 0.14               | 0.27        | 0.12                | 0.20        | 0.35              | 0.37             | 1.00                            | <b>0.57</b>                     | 0.56                             | 0.42        | 0.34                             | 0.31                 | 0.57        | 0.50               | 0.12              | 0.45              | 0.50              | 0.37               |
| H <sup>13</sup> CO <sup>+</sup>  | 0.21        | 0.39        | 0.32               | 0.38               | 0.48        | 0.25                | 0.26        | 0.47              | 0.36             | <b>0.57</b>                     | 1.00                            | <b>0.78</b>                      | <b>0.67</b> | 0.48                             | 0.31                 | 0.57        | 0.66               | 0.26              | 0.70              | 0.55              | 0.57               |
| CH <sub>3</sub> CCH              | 0.15        | 0.36        | 0.26               | 0.33               | 0.51        | 0.15                | 0.33        | 0.49              | 0.39             | 0.56                            | <b>0.78</b>                     | 1.00                             | 0.63        | <b>0.55</b>                      | 0.37                 | 0.58        | 0.59               | 0.15              | 0.73              | 0.55              | 0.54               |
| 3mm                              | 0.14        | 0.34        | 0.35               | 0.34               | 0.39        | 0.14                | 0.15        | 0.34              | 0.24             | 0.42                            | <b>0.67</b>                     | 0.63                             | 1.00        | 0.54                             | <b>0.51</b>          | 0.34        | 0.48               | 0.23              | 0.59              | 0.51              | 0.54               |
| CH <sub>3</sub> C <sub>3</sub> N | 0.11        | 0.22        | 0.17               | 0.23               | 0.36        | 0.04                | 0.16        | 0.34              | 0.16             | 0.34                            | 0.48                            | <b>0.55</b>                      | 0.54        | 1.00                             | 0.48                 | 0.20        | 0.32               | 0.06              | 0.54              | 0.44              | 0.49               |
| CH <sub>2</sub> CHCN             | 0.09        | 0.18        | 0.23               | 0.08               | 0.16        | 0.01                | 0.09        | 0.11              | 0.06             | 0.31                            | 0.31                            | 0.37                             | <b>0.51</b> | 0.48                             | 1.00                 | 0.11        | 0.18               | 0.00              | 0.31              | 0.35              | 0.31               |
| CCH                              | 0.19        | 0.30        | 0.22               | 0.29               | 0.36        | 0.22                | 0.28        | 0.42              | 0.54             | 0.57                            | 0.57                            | 0.58                             | 0.34        | 0.20                             | 0.11                 | 1.00        | <b>0.59</b>        | 0.15              | 0.51              | 0.50              | 0.40               |
| HN <sup>13</sup> C               | 0.39        | 0.45        | 0.39               | 0.53               | 0.49        | 0.39                | 0.40        | 0.47              | 0.50             | 0.50                            | 0.66                            | 0.59                             | 0.48        | 0.32                             | 0.18                 | <b>0.59</b> | 1.00               | <b>0.39</b>       | <b>0.78</b>       | 0.56              | 0.65               |
| NH <sub>2</sub> D                | 0.13        | 0.10        | 0.13               | 0.17               | 0.09        | 0.11                | 0.03        | 0.05              | 0.11             | 0.12                            | 0.26                            | 0.15                             | 0.23        | 0.06                             | 0.00                 | 0.15        | <b>0.39</b>        | 1.00              | 0.20              | 0.14              | 0.15               |
| HC <sub>3</sub> N                | 0.35        | 0.52        | 0.39               | 0.61               | 0.61        | 0.37                | 0.52        | 0.54              | 0.39             | 0.45                            | 0.70                            | 0.73                             | 0.59        | 0.54                             | 0.31                 | 0.51        | <b>0.78</b>        | 0.20              | 1.00              | <b>0.58</b>       | <b>0.76</b>        |
| HC <sub>5</sub> N                | 0.21        | 0.34        | 0.34               | 0.29               | 0.35        | 0.23                | 0.27        | 0.41              | 0.37             | 0.50                            | 0.55                            | 0.55                             | 0.51        | 0.44                             | 0.35                 | 0.50        | 0.56               | 0.14              | <b>0.58</b>       | 1.00              | 0.51               |
| H <sup>13</sup> CN               | 0.40        | 0.53        | 0.42               | 0.58               | 0.62        | 0.41                | 0.40        | 0.59              | 0.41             | 0.37                            | 0.57                            | 0.54                             | 0.54        | 0.49                             | 0.31                 | 0.40        | 0.65               | 0.15              | <b>0.76</b>       | 0.51              | 1.00               |

### Shock group

HNCO 4<sub>0,4</sub>→3<sub>0,3</sub>  
OCS 8→7  
H<sub>2</sub>CCO 5<sub>1,5</sub>→4<sub>1,4</sub>  
CH<sub>3</sub>OH 2<sub>1,1</sub>→1<sub>1,0</sub>  
SO 2<sub>2</sub>→1<sub>1</sub>  
CH<sub>3</sub>CHO 5<sub>1,4</sub>→4<sub>1,3</sub> (--)  
SiO 2→1  
C<sup>33</sup>S 2→1  
HCS<sup>+</sup> 2→1

### Excluded

NH<sub>2</sub>D (1,1)

### Continuum group

c-C<sub>3</sub>H<sub>2</sub> 2<sub>1,2</sub>→1<sub>0,1</sub>  
H<sup>13</sup>CO<sup>+</sup> 1→0  
CH<sub>3</sub>CCH 5<sub>2</sub>→4<sub>2</sub>  
3mm  
CH<sub>3</sub>C<sub>3</sub>N 24<sub>3</sub>→23<sub>3</sub>  
CH<sub>2</sub>CHCN 9<sub>0,9</sub>→8<sub>0,8</sub>  
CCH 1,3/2,1→0,1/2,1  
HN<sup>13</sup>C 1→0  
HC<sub>3</sub>N 11→10  
HC<sub>5</sub>N 33→32  
H<sup>13</sup>CN 1→0