one wrote to McTague that true commissioning of the ring could not be considered to have begun until problems with "flaky hardware" were overcome.

What remains to be done? Both the ultraviolet and x-ray rings need to store higher current electron beams. All other conditions equal, the more electrons in the beam, the more light is emitted. Both machines' design specifications call for considerably higher currents than high-energy physics storage rings can tolerate. There are instabilities that are unique to the high-current machines, and so they have not been addressed in high-energy physics accelerators. Some of these have already been encountered in the ultraviolet source, where the circulating current in the ultraviolet ring should eventually reach 1 ampere. It is about 0.3 ampere now. The NSLS x-ray ring has a lot farther to go. The maximum current so far is 14 milliamperes, with the goal being 500.

Moreover, the x-ray ring is not fully completed. A vacuum bake-out system is just being installed this month. Without it, the vacuum has been below specifications. Collisions between the electrons in the beam and residual gas molecules eventually deplete the beam, limiting its lifetime. And the existing radio-frequency cavity is insufficient to accelerate a high-current beam to the 2.5-GeV design energy. A second one has yet to be tested and put in place.

As for when x-ray users can expect photons, Krinsky cautiously predicts this January, but only if nothing unexpected goes wrong. Spring is more likely, he concludes. Krinsky's bottom line is that it is "only when you know what the problems are that you know how long it will take to fix them."

The same situation pertains at Wisconsin. Aladdin does everything it is supposed to do except store a high beam current. Rowe is telling his users to plan on a December starting date for hooking up their equipment. But Wisconsin's resources are, if anything, slimmer than Brookhaven's for the NSLS. Aladdin's construction budget was $4.5 million.

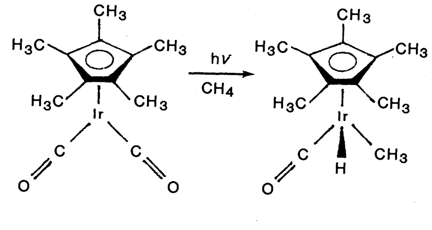
Everyone has to stretch dollars when funding is tight. Perhaps, however, there is a limit to the stretching. If, as presidential science adviser George A. Keyworth, II, has repeated more than once, the NSLS is an example of the excellence to be supported in times of lean budgets, then those proposing such facilities should have the courage to ask for adequate resources to build and operate them, and Congress and the funding agencies should be willing to provide the wherewithal.—**Arthur L. Robinson**

Methane C–H Bonds Activated

One of the foremost goals of many organometallic chemists is the use of transition metal complexes to activate—insert a functional group into—saturated and aromatic hydrocarbons. Activation allows further reactions to be carried out on the hydrocarbon, particularly reactions that would make it useful as a precursor to organic chemicals. Such activation has been achieved for most types of hydrocarbons (*Science*, 17 June, p. 1261) with a single important exception—methane. Methane has the strongest C–H bonds of any simple hydrocarbon and has proved exceptionally resistant to activation. This is unfortunate because methane is a widely occurring hydrocarbon gas that would, in many ways, be ideal as a source of both synthetic fuels and chemicals.

At the recent meeting of the American Chemical Society (ACS) in Washington, two groups of investigators reported independently that they had finally coaxed methane into adding oxidatively to a transition metal complex. The reaction described by one group was photochemical and that of the other was thermal, but the two approaches were nonetheless very similar and similar complexes were used in each.

William A. G. Graham and his colleagues at the University of Alberta used a simple iridium complex, $[\eta^5 - C_5(CH_3)_5]Ir(CO)_2$. When this complex is dissolved in perfluorohexane at room temperature under about 8 atmospheres of methane and illuminated, methane is added oxidatively to form the new complex $[\eta^5 - C_5(CH_3)_5]Ir(CO)(H)CH_3$. This complex is very unstable, but can be readily converted to the very stable complex $[\eta^5 - C_5(CH_3)_5]Ir(CO)(Cl)CH_3$ by reaction with carbon tetrachloride. Formally, this complex might be considered to be one in which chloromethane has added oxidatively, but Graham has not yet been able to reverse the process and expel chloromethane. Similar results have been obtained in a complex with a cyclopentadienyl ligand instead of the pentamethylcyclopentadienyl ligand.



Robert G. Bergman and his colleagues at the University of California, Berkeley, first tried to photolyze a similar complex, $[\eta^5 - C_5(CH_3)_5][P(CH_3)_3]IrH_2$, in perfluoroalkane solvents, but they were not successful. Bergman then reasoned that the desired methylated complex should be thermodynamically more stable than a complex with a secondary alkyl group, such as a hydridocyclohexyl complex, $[\eta^5 - C_5(CH_3)_5][P(CH_3)_3](C_6H_{11})(H)$, that he and Andrew H. Janowicz had prepared last year. When this complex was dissolved in cyclooctane and heated to about 150°C under 20 atmospheres of methane, the corresponding hydridomethyl complex was formed. This product was also unstable, but it too could be readily converted to the chlorine complex.

Strictly speaking, neither of these two cases represents the first time that methane has been activated with an organometallic complex. At last spring's ACS meeting, Patricia L. Watson of the Du Pont Company reported that certain lutetium and yttrium complexes undergo exchange reactions in which unlabeled methane bound to the complex exchanges with $^{13}CH_4$ in solution. This exchange suggested that methane C–H activation was possible, but it was a nonproductive reaction in the sense that there was no net increase in the amount of activated methane. Some investigators, furthermore, argue that the reaction of methane in Watson's case was not an oxidative reaction of the type sought.

The next step, which has also proved difficult with other hydridoalkyl complexes, is to force release of a functionalized hydrocarbon from the complex. If it should be possible to add a carbonyl to the methyl moiety, for example, the reaction would have great utility for synthetic purposes. For now, however, such a development still seems to be some time away.

—**Thomas H. Maugh II**